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STAMMERING AND COGNATE
DEFECTS OF SPEECH

STAMMERING AND COGNATE DEFECTS OF SPEECH

BY

C. S. BLUEMEL

VOLUME I

THE PSYCHOLOGY OF STAMMERING

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PREFACE

FIVE years ago the author began a systematic investigation into the cause of stammering. In his preliminary notes he wrote as follows :

"The true theory of causality must explain *all* the facts. It must explain the fact —

"That the stammerer can usually sing without difficulty.

"That the stammerer can often speak well when alone.

"That the stammerer is usually fluent when speaking in concert with other people.

"That the stammerer can usually repeat fluently the words that are pronounced for him by another person by way of assistance.

"That the stammerer can usually repeat a word that he has eventually stammered out.

"That consonants followed by short vowels are more difficult for the stammerer than consonants followed by long vowels.

"That consonants at the end of a word never occasion difficulty.

"That the stammerer may have difficulty on words that commence with vowels.

"That the speech-defect may assume the most diverse forms, being in one case passive, and in another active and boisterous."

"That one can stammer in thought as well as in speech.

"That there are more male than female stammerers.

"That stammering is rarely acquired after the fifteenth year." Etc., etc.

The theory of causality that the author has arrived at affords what appears to be a satisfactory explanation of the various paradoxes mentioned. The theory has been developed in large part as the result of in-

tropective evidence, — evidence as indispensable as it was uncoveted.

The theoretical discussion of the causality and psychology of stammering is presented in the first volume of this book.

In the second volume the author has reviewed and criticised the systems at present employed in treating stammering in Europe and America. He has thus fulfilled, at a somewhat late date, the wish that Schulthess and some of his contemporaries expressed nearly a century ago — that some one would embody in a single volume all known systems applicable to the treatment of stammering. But lest the words "all known systems" should imply too much, let the author add that he does not profess to be omniscient; and, further, that the systems that he has reviewed are merely those that he knows to be current or to have been recently current in the therapy of stammering. The author has made no attempt to undertake an historical review, since this field has been effectively covered by Hunt in his "Stammering and Stuttering." The contemporaneous systems given represent, however, the principal methods of the United States of America, Canada, the British Isles, France, Switzerland, Germany, Belgium, Holland, Denmark, Scandinavia, Russia, and Austria. These systems are therefore thoroughly representative of those employed in the civilized world.

The systems cited in this review have not, as a

rule, been given for their sovereign merit. Indeed, many of the systems are entirely devoid of merit; they have been recorded merely because they are the gold bricks that are daily sold to stammerers by an infamous fraternity of "speech specialists." These wretched systems—and, indeed, most elocutionary systems—must inevitably become obsolete with the advancement of the psychological investigation of stammering. But meanwhile progress is hampered by charlatans, who rob the stammerer and bring everybody and everything connected with the treatment or investigation of stammering into disrepute. Manifestly it is incumbent upon stammerers themselves to remedy these conditions.

A glossary has been appended to the second volume of the book. This has been made sufficiently comprehensive to render the book available to the youthful stammerer.

The author is indebted to Professor V. A. C. Hemon (of the Department of Psychology at the University of Wisconsin) and to Professor Lawrence W. Cole (of the Department of Psychology at the University of Colorado) for valuable criticisms of the first volume of this monograph. The author is also indebted to the numerous friends that have in various ways and at various times assisted him in the preparation of the work.

C. S. B.

BOULDER, COLORADO,
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THE PSYCHOLOGY OF STAMMERING

CHAPTER I

INTRODUCTION

STAMMERING and cognate defects of speech have in the past been studied almost exclusively in their physical manifestations. The point of view has been that of physiology. In the present work the subject will be considered primarily in its mental aspect. The point of view will be that of psychology. For this reason it will be necessary at the outset to consider a few of the fundamental principles of psychology itself, and the meanings of the psychological terms that will occur most frequently in this monograph.¹

PSYCHOLOGY

Psychology is commonly defined as the science of mental life, or the science of consciousness. It is the study of the mental processes, — of their nature and function.

¹ A complete glossary is also given at the end of the second volume.

SENSATION

By *sensation*, the psychologist means the consciousness arising from the stimulation of one of the bodily sense-organs. One has sensations of sight as ether-waves impinge upon the retina of the eye; sensations of sound as air-vibrations strike the drum of the ear; sensations of smell when free particles of matter, floating in the atmosphere, stimulate the olfactory nerves; and so on.

The senses were formerly considered to be five in number, — sight, hearing, feeling, taste, and smell. To-day the number of senses recognized by the psychologist is in the neighborhood of eighteen. Each is regarded as an elementary sense with special end-organs conveying the sensory current to the brain. "Feeling" (or touch) is differentiated into elementary sensations of pressure, pain, warmth, and cold. Closely allied to this group are the kinæsthetic sensations, — sensations involved during muscular activity. The kinæsthetic sensations are conveyed to the brain by sensory nerves found in the muscles, tendons, and joints. These sensations are felt in the arm as one lifts a heavy weight; they are felt chiefly in the fingers and forearm as one clenches the fist; they are detected in the lips and tongue during speech. The organic sensations may be included as further subdivisions of "feeling." They are sensations from within the body

itself, — feelings of hunger, thirst, and nausea, and sensations from the respiratory and circulatory systems. (These sensations are distinctly emotional in their coloring. They will be considered in their relation to the emotions in Chapter IX.) The static sensations report the movements of the body as a whole.

A sensation is sometimes spoken of as an *impression*.

MENTAL IMAGES

Sensations arise as the result of the actual stimulation of the sense-organs. They may, however, be revived in memory quite independently of the stimulus, in which case they are known as *mental images*. Mental images are often dim and fugitive, but in dreams and hallucinations they are sufficiently intense to be mistaken for actual sensations. During the waking state the sensations that one experiences are usually too vivid to allow mental images to come conspicuously to the foreground of consciousness. However, as one is sitting in perfect quietness in the dark, mental images frequently present themselves with considerable clearness. In reverie one reviews old scenes and scans the faces of absent friends; one hears absent voices, and enjoys music that comes back in thought.

These mental images are not restricted to any particular field of sensation; they may represent *any* sensation that has occurred in consciousness. They

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are not the mere habitants of dreams, nor is there anything poetic or fantastic in their nature. They are the material with which we think; and they are just as indispensable for the solution of a problem in geometry as they are for the production of an artist's masterpiece.

The *visual image* is easily recognized if one glances at some object — a picture, for example — and immediately closes the eyes. There is no definite point in time at which the sensation can be said to vanish; certainly it does not terminate with the closing of the eyes. For a moment the mental picture is present with vivid color and accurate detail. One can examine it for points that escaped observation during actual vision. Strictly speaking, this mental picture is an after-sensation. It is called the *primary mental image*, in contradistinction to the *secondary image*, — the *re-called image*, or *memory-image* proper.¹

Memory-images differ from sensations mainly in the fact that they are usually less distinct. These secondary visual images are present in the mind as one recalls any visual experience, — as one sketches a scene from memory, for instance. Artists frequently have so vivid a memory for visual impressions that

¹ The visual after-image is often a negative image; *i.e.* there is an inversion of light and shade, as in the photographic negative. In the negative after-image the spectral colors are replaced by their complementary colors.

they are able to paint, with the greatest accuracy of detail and color, scenes that they have not beheld for years.

Visual images are usually clearest the first moment they arise in consciousness. As a rule, they do not become clearer with mental fixation. In this respect the visual image might be compared to the visual impression that one gets from the sun, or a brilliant light flashing out in the darkness. For an instant the vision is distinct, but it melts in a moment to a shapeless blur. In many cases the analogy will not hold. Some people can scrutinize their visual images at will; with others the image is not clear even at the moment of its first appearance in consciousness. Under abnormal conditions the mental image may assume the vividness of an actual sensation. In this case there is usually an "hallucination." The condition is pathological, and does not frequently occur. To it may be attributed many of the supernatural phenomena that excite the wonder of the credulous. It is safe to say that no self-respecting ghost would haunt anything but a mind affected by a disordered liver. Frequently the subject of such an experience is fully aware of the hallucinatory character of the sights that he sees or the sounds that he hears. In this case he is said to experience a "pseudo-hallucination."

Auditory images are present in one's memory of

sounds. One listens to "ear-haunting" tunes. A person picks up a musical score; and, as he reads the notes, hears the tune in mental imagery. A musician may compose music in a train, jotting down the notes as the strains of music rise in his mind. One may listen in memory to the commoner physical sounds, hearing in auditory images the rumble of a wagon in the street or the *clop-clop* of horses' hoofs. After a tedious train journey many people hear for hours the clangor and rumble of the train.¹

In audition, again, we have the primary mental image, — occurring in the form of a mental "echo." The primary memory is often conspicuous where the secondary memory for sounds is deficient.

Tactual images (or touch memories) are often quite clear when they reflect distinctive sensations. One "feels" the soft, cold petals of a rose as it is (in imagination) touched to the lips. One can recall the cold, smooth feeling of marble or the soft feeling of velvet, and mentally contrast these feelings with the rough feeling of sandpaper. One can imagine the sensation that would result from plunging the hands into hot water, or the freezing chill one would experience on falling through the ice. (These last two are, strictly speaking, *thermal* images.) One may have images

¹ People differ greatly in their capacity for recalling the experiences of the different senses. This point will be considered in Chapter II in the discussion of *mental types*.

of pain whilst listening to the vivid description of an accident; and one may imagine the pain of running broken glass into the fingers or cutting the fingers with a knife.

Gustatory images arise in the mind as one listens to the description of a feast. The writer recently read an account of an antarctic expedition in which the explorers, when their pemmican was low, would amuse themselves for hours by describing by turns the sumptuous feasts they would enjoy upon their return to civilization. After the descriptions they would vote upon the menus. There was roast turkey, steaming-hot plum pudding, and numberless other things that would appeal to starving men. The pleasure of the pastime was, of course, in the play of the gustatory imagery.

Olfactory images are often present in the stream of consciousness. One may recall in mental imagery the smell of burning tobacco, of cooking bacon, the odor of a rose, of cheese, of garlic, and of numerous other objects that have occasioned olfactory sensations.

Kinæsthetic, or motor, images will occupy a position of prominence in later discussions. They are the memories of muscular movements,—memories of the muscular feelings involved in clenching the fist, in flexing or extending the arm; they are images of the movements made in writing, in playing the

piano, and in speaking; they are, in fact, the remembered feelings of any muscular movement whatever. People that have lost an arm can often mentally move the lost hand and work the missing fingers. These movements occur, of course, in kinæsthetic imagery.

Mental images are representative of past sensations. It is quite impossible for one to imagine a sensation that has not been experienced. A man that is born blind can never imagine the sensations of sight. A man that has not looked at the moon through a telescope cannot imagine what the appearance of the moon would be. A man that has never heard an Indian tom-tom can have no auditory image that represents the sound. A man that is born deaf has no auditory imagery whatever. Not only is he unable to imagine sounds, but he is totally unable to imagine what sound is like. A person that is born deaf remains dumb because he has never heard words, and is consequently unable to call up word-images in his mind.¹

Mental images may, however, be recombined so that the collocation is original. One can imagine a winged horse, without having seen such a beast. But both the horse and the wings have occurred separately in experience. One pictures to himself

¹ This last statement will be modified later. See pp. 46 ff. and p. 95.

a purple moon, — a thing apparently original. Yet he has formerly seen the moon and experienced the color purple. He has merely recombined elements of his past experience. In the last analysis, the elements of any combination of mental imagery will be found to be reproductions of one's former sensations.

Imagination is called *productive*, or *constructive*, when it involves an original collocation of mental images. It is termed *reproductive* when it involves a mere reproduction of sensations — in the arrangement in which they occurred. Reproductive imagination is thus practically identical with memory. However, the mere duplication of sensations in mental imagery is not memory. There is necessary, in addition, the knowledge of the fact that the mental images portray former experiences.

A mental image is sometimes referred to as an *idea*. Strictly speaking, it is an idea only when it is considered in relation to its meaning.

ASSOCIATION

The association of ideas in the mind is due largely to previous experience. If two sensations have occurred together, the mental image of the one is likely to reintegrate, or recall, the mental image of the other. The phenomenon is due to mental or neural habit. The tunes of the English and German national anthems and the American national song,

"America," are identical. When the German hears this particular air, he immediately thinks of the words "Heil Dir im Siegerkranz"; the American, on hearing the melody, associates it with the words "My Country, 'tis of Thee"; and the Englishman associates the same tune with "God save our Gracious King." In each case the associations are due solely to experience: the words and the tune have occurred together in the past. Again, one picks up a volume of Milton, and in a few seconds inquires the name of the last Emperor of China. What is the connection? The book suggested printing; China was thought of as the home of printing; the interest then turns to the country's political affairs, and prompts the question concerning the emperor. The associations are due to contiguity.

Ideas thus suggest one another when the experiences that they represent have been contiguous either in time or in space. In passing a certain house one is reminded of the people that live there. The association is one of *spatial contiguity*. Similarly, an orange reminds the town-bred man of a fruiterer's shop; while it reminds the orange-grower of his orange groves. In each case the associations are due to the fact that the objects thought of have been adjacent in space. By *temporal contiguity* an orange-grove may remind one of a toothache for the reason that he was suffering from toothache at a time when he

visited an orange-grove. Again, the sound of a particular melody may recall the place where it was heard. In these cases the association is one of temporal contiguity.

For two objects to be associated in space they must of course appeal to sight or touch. But when objects are seen or felt together, they must be seen or felt simultaneously; therefore spatial association always involves temporal association. On the other hand, when two experiences are associated only in time, one or both must appeal to a non-spatial sense — such as hearing, smell, or taste, for instance; hence normal temporal association excludes spatial association.¹ It follows that there is a double connection between things seen or felt together, and but a single connection between conjoined experience of the other senses.

When sensations follow one another, the association is always stronger in the order of the occurrence. After learning the alphabet forwards, one cannot immediately say it backwards.

The associations in the minds of lower animals are almost exclusively those of contiguity. The stage-feats of so-called performing animals are explained by the associations of certain bodily movements with

¹ Sounds and odors can, of course, be thought of as coming from a particular point in space; but in this case the spatial relation is expressed in the mind in terms of sight or touch.

signals given from behind the scenes. The performing horse stamps his hoof as the attendant in the wings waves a flag. He responds merely as an automaton, and it is needless to say that he knows nothing of the questions that he is credited with answering.

There is a distinctive form of association that sunders the human mind from that of the brute; it is *association by similarity*. When the round stone suggests a hammer and the sharp stone an axe, when a springing branch suggests a bow and the falling of an apple suggests the mutual attraction of bodies; then the human mind supersedes experience. When a person's associations are those of contiguity, he must inevitably be a clumsy and laborious thinker. He plods along, thinking in mental brickbats, and erecting his thought-structures piece by piece. The person associating things by similarity holds, as it were, the magic wand of thought. A bare suggestion, and the whole superstructure of thought stands complete: the process seems sufficiently thaumaturgic to transcend the laws of association.

Genius, it is held by some psychologists, is identical with the possession of "similar" association to an extreme degree. This faculty is accounted sufficient to explain the achievements of the Newtons and the Darwins.¹

¹ There is considerable difference, however, between obeying similarity and detecting it. Genius is rather the faculty for detect-

Contrast, as a cause of association, is but another phase of similarity. *Cause and effect* is reducible to contiguity.

It is beyond question that we are no more able to ignore association in our thinking than we are able with our mental images to transcend experience. One idea is not able to reintegrate any other idea that we may wish. The ideas that it recalls must be associated by contiguity or similarity. At best we can seize upon one of several ideas that present themselves. Associations do appear that seemingly violate all these relations; yet the associations undoubtedly occur in the fringe of consciousness. There are in our minds rudimentary and fugitive thoughts that do not come to the focus of attention. Writing on obscure associations, James says:¹ "If I hear a friend describe a certain family as having *blotting-paper* voices, the image, though immediately felt to be appropriate, baffles the utmost powers of analysis." The relation here appears to be hidden in the shadows of the mind. If one could admit similarity between the experiences of disparate senses, he would probably

ing it. (See James, "Principles of Psychology," Vol. II, p. 361.) Efficiency in abstract thought is perhaps due to the ability to attach the maximum of meaning to a minimum of imagery. The question then arises as to the nature of *meaning*, and it may be found that meaning is as much dependent upon contiguous association as upon similar association.

¹ "Principles of Psychology," Vol. I, p. 582.

seek a resemblance between the characteristic quality of the voices and the soft feeling of blotting-paper. It seems difficult, however, to believe that there can be similarity between the experiences of unrelated senses. It may perhaps be that the resemblance lies between the sound that results from tearing blotting-paper, and the sound of the thick and somewhat husky voices to which the paper is compared. The association would then be complex, involving both similarity and temporal contiguity. Many such associations occur that, for the time being, defy analysis. Frequently it is only by chance that one stumbles upon the explanation. There can be little doubt, however, that a relation of contiguity or similarity invariably exists.

PERCEPTION

Perception is the mental process by which the mind associates sensations with mental images. The bare sensation is not an element of knowledge. It is a mere "that." The *percept* is a "that which." It is the sensation, plus its associated images. Bare sensations, then, do not frequently occur in adult life. As one inhales the fragrance of a rose, attending merely to the odor, he experiences something akin to the pure sensation. But generally things are regarded for their meaning. One hears a rumble in the distance, and "perceives" a train. The rumble, however, is

a mere auditory sensation. The idea of the train arises by virtue of association, the sound suggesting the train's appearance and other qualities. The reader sees printed words on the page before him. The words are so many black marks upon a white background. They have meaning only because they are associated with certain sounds, — the spoken words they represent. The spoken words, in their turn, are purely arbitrary symbols. Frequently they have different meanings in different languages.¹ The meaning is determined entirely by the object, action, etc., that the word recalls.

The mind in reality contributes the greater part of the percept. The bare sensation resulting from the stimulation of the peripheric sense-organ is nothing more than a cue. As a unitary thing it is devoid of meaning. The multitudinous associations alone confer meaning upon it. One sees a table top as a square, though the retinal image is that of a rhombus. A figure in the distance is perceived as a man, though one can "cover" him with the little finger. A boy, a little nearer, produces a retinal image ten times as large; yet the boy is not mistaken for a giant. It is the mind's contributions, the associations, that prevent utter chaos in the interpretation of impres-

¹ "The Chilians say *papa* for 'mother,' and the Georgians say *mama* for 'father,' while in various languages *dada* may mean 'father,' 'cousin,' 'nurse'; *tata*, 'father,' 'son,' 'good-bye!'" (Tylor, "Anthropology," p. 129.)

sions. Common illusions are due to the mind's contributing the wrong images to a "misinterpreted" cue. One hears the rustle of leaves, and mistakes the sound for approaching footsteps; or, seeing a shadow on the wall, one "perceives" a ghost. The illusion is due to the fact that an inappropriate image advances to meet the sensation.

CONCEPTION

A *concept* is a congeries of associated mental images. The act of the mind in regarding the relation between these images, or the relation between different concepts, is called *conception*. The concept of an apple may be regarded as the following group of associated mental images: the visual image of its appearance, the image of its taste, the image of its smell, the image derived from handling it, and the verbal image of its name. There might be still other images, more or less nascent, — the memory of the sound produced by paring an apple, and a kinæsthetic image of the biting action of the jaw, for instance. One particular image usually forms the nucleus of the concept. In the present case it would most likely be the visual image of the fruit, or the verbal image of the word "apple." The images associated with the nucleus do not usually come to the foreground of consciousness. Some of the images may be entirely lacking. A person born blind would have no visual images in his con-

cepts; a congenitally deaf man would have no images of sound.

When the concept is of an abstract nature, the nucleus is usually a verbal image. The nucleus of a concept used in communication is almost invariably an arbitrary symbol of this kind, — a spoken or written word, a word spelled out in the manual alphabet or in telegraphic code. However, the symbol contains no innate meaning; its import is derived solely from the mental images with which it is associated.

COGNITION, AFFECTION, AND VOLITION

The mental processes are sometimes classified under the three headings, *Cognition, Affection, and Volition*; in other words, *knowing, feeling, and willing*.

The *cognitive processes* are those that convey the elements of knowledge. Such, for instance, are Sensation, Perception, Conception, Judgment, and Reasoning. (Judgment and Reasoning are merely more complex processes of conception and association.) *Affection* is the emotional coloring of the cognitive states. It is the pleasantness or unpleasantness of a particular experience, — the pleasantness in the odor of a rose, the unpleasantness in a toothache. As Angell¹ puts it, cognition gives the "what"; affection gives the "how." Cognition and affection

¹ "Psychology," p. 302.

are merely different aspects of the same mental states.¹

For the present discussion the *will* may be regarded subjectively as the decision to act. Objectively, it is the biological property of "irritability"; *i.e.* the tendency of all living matter to express a sensory stimulus in a motor response.² The subject will be considered a little more fully in a later chapter.

THE NATURE OF THOUGHT

Words are by no means essential to thought. The whole breadth of the stream of consciousness may be engaged by a series of sensations and perceptions. One may walk through the country, drinking in the sights and sounds, with never a verbal thought in one's mind. For conception, too, one may dispense with words entirely. In playing chess, solving problems in geometry, designing bridges and machinery, visual images alone are necessary. In composing music, auditory images suffice; verbal images would be an encumbrance.

Meeting a person in the street, one may think to himself, "I wonder if that man is the actor I saw performing last evening;" yet not a single word need be contained in the idea. The visual impression arouses

¹ As will be explained in Chapter IX, the emotions are, in their last analysis, organic sensations in which affection is at a maximum and cognition at a minimum.

² This is the *law of dynamogenesis*.

the image of the actor as he was seen upon the stage, and the relationship of identity presents itself to the mind in some recondite manner that is no less inscrutable than consciousness itself. Again, the *visual* imagery may "reply," "No, this man is too tall, and too stout." No words would be necessary unless the thought were to be communicated to another person. In this case the words would not be understood unless — as purely arbitrary symbols — they aroused the appropriate visual images in the mind of the auditor. The whole thought-process might well occur in the mind of a deaf and dumb man that had never heard or spoken a word in the course of his existence. The thought may, of course, be accompanied or followed by verbal images, but in this case the words are visually initiated, just as they are visually interpreted by the person that hears them spoken.

To take another instance:—A man stands upon the doorstep surveying the sky; then decides to reënter the house for his umbrella. The thought-process is probably as follows: The black clouds conjure up in the man's mind visual images of falling rain (or he may have tactual images of raindrops striking his cheeks). He then visualizes himself in the act of holding up an umbrella. This image immediately redintegrates another visual image of the umbrella standing in a particular part of the house,

and he thereupon decides to fetch it.¹ There might arise in his mind the words, "I must get my umbrella"; but if they appear, they do so *after* the decision to act, — that is, when the thought-process is complete. The words have no intrinsic part in the thought; they are purely epiphenomenal. If, by sheer association, the clouds could arouse the verbal thought, "It is going to rain," the words would still mean nothing without their visual associates. If this thought were followed by the words, "I must get my umbrella," the man would still be no farther forward if there were lacking concrete images of his umbrella and the place where it stood. He would be in the position of a parrot that echoes words without understanding them.

Words, then, are not indispensable to thought. A congenitally deaf person that has not mastered language can carry on an intelligent conversation in demonstrative and imitative gesture. A person may lose all memory of words (a pathological condition known as *amnesia verbalis*, or *verbal amnesia*), and yet maintain a high order of intelligence. This is accounted for by the fact that much of our ordinary thought proceeds in visual, auditory, and kinæsthetic imagery. Concrete objects are thought

¹ We might introduce kinæsthetic images at this point. As the subject of voluntary muscular movements has not yet been fully discussed, the kinæsthetic images are omitted.

of in visual terms, and their names may be totally ignored.¹

Abstract thought, as well as concrete thought, may proceed in non-verbal imagery. The writer finds that much of his abstract thought is conducted in visual and motor terms, the motor images being frequently those of eye-movements. Considered with reference to their content, the images are meagre and rudimental; considered in regard to their function, they are frequently more cogent than elaborate collocations of verbal images. The writer was recently listening to a discussion concerning a parabola, in which the explanation was somewhat desultory. A visual image of a parabola was in the mind. During the discourse the method of handling the subject was suddenly criticized — as it were, in an undercurrent of consciousness — by a thought whose content was nothing more than a mental glance across the arms of the parabola, and then around its contour. The following verbal interpretation of the thought was written within three minutes of the occurrence of the incident: "A person that is not a logical thinker is apt to proceed on the assumption that his auditor's mental imagery is identical with his own. He discusses particular details simply and solely because some point in his imagery happens to attract his

¹ Consequently the names of concrete objects are often forgotten first in old age.

attention; for this reason the method of procedure is entirely adventitious. The methodical thinker, on the other hand, first examines his mental imagery and assures himself that it is adequate to the discussion; then he builds up, piece by piece, the same imagery in the mind of the hearer. This done, they talk to an identical purpose." The glance across the parabola symbolized the desultory thought. The glance around its contour represented the methodical procedure. The two processes were mentally contrasted. As an interpolation, the thought would have been too involved to find expression in words, for the attention deviated scarcely a moment from the words of the speaker.

Much of one's thinking is, however, conducted in verbal imagery. Language originated as a means of communication;¹ but it has become an instrument of thought for the reason that words have become nuclei of concepts. As concepts grow more abstract

¹ The earliest linguistic efforts are supposed to have been imitative emotional cries. "When English *woe* is traced back to Anglo-Saxon *wa*, it is found to be an actual groan turned (like the German *weh*) into a substantive expressing sorrow or distress." (Tylor, "Anthropology," p. 126.) A further advance in evolution would be represented by the addition of onomatopoeic, or imitative, words. Such, for instance, are the words *buzz*, *hum*, *clatter*, *ding-dong*, *pewit*, *mew*, etc. Words of this kind would soon lose all trace of their origin. This can be readily understood when one notices the great dissimilarity between English and German words that were once identical.

and general, the representation becomes more largely verbal, and less and less visual. Ideas of *integrity*, *thriflessness*, *incompatibility*, *plasticity*, *speed*, etc., are with many people almost purely verbal in their representation. Consequently these people find mental language indispensable for abstract thought; though their concrete ideas may be portrayed in other forms of imagery. Many people are greatly reduced in intelligence when suffering from verbal amnesia.

It is by no means essential, however, that the abstract concept be built up around the *spoken* word. The nucleus may just as well be a graphic representation, — a diagram, an Egyptian hieroglyph, a conventional scriptory symbol. In the case of deaf-mutes it may be a gesture, or a sign in the manual alphabet, — mentally represented in visual or motor terms. With the blind, the nucleus of a concept may be a tactile image of raised print. In the case of the deaf-blind it may be a word tapped out (by the Braille system) into the palm of the hand. The imagery may be in either kinæsthetic or tactile terms, — the subject imagines himself tapping the words into the palm of another person, or imagines the words being tapped into his own hand.

The concept-nucleus is, then, often entirely arbitrary. It makes no difference whether a horse is called *horse*, *pferd*, or *cheval*. It makes no difference whether the word *integrity* is heard as sound, is seen

as marks on paper, or is felt as somebody's finger-movements in one's hand. The meaning of these symbols inheres in the congeries of associated mental images that are either overtly or nascently aroused.

CHAPTER II

MENTAL TYPES: EYE-MINDEDNESS, EAR-MINDEDNESS, ETC.

As Ribot has appropriately remarked, we have memories rather than memory. We have, as it were, a number of separate and individual minds, — an auditory mind, a visual mind, a kinæsthetic mind, a tactile mind, and so on. These minds may be conjointly or separately active. One may think simply of the appearance of a rose, or he may think simultaneously of its appearance, its fragrance, and the softness of its petals.

One or more of these minds may be entirely lacking. A blind person has no images of sight; a deaf person, no images of hearing. The deaf-blind have images for neither of these senses. A child that becomes blind before the age of six or seven loses his visual memory. Similarly, a child becoming deaf loses all imagery of sounds. In the case of Laura Bridgman — who, as a child, suffered loss of the senses of sight, hearing, taste, and smell — the world of sensation and memory would be almost exclusively tactile and kinæsthetic. There must, then, be considerable difference in the workings of individual minds.

"Sounds certainly play a far more prominent part in the mental life of the blind than in our own. In taking a walk through the country, the mutations of sound, far and near, constitute their chief delight. And to a great extent their imagination of distance and of objects moving from one distant spot to another seems to consist in thinking how a certain sonority would be modified by the change of place."¹

A congenitally deaf person could have no such experience. For him, sensations and memory of hearing have no existence. He sees things, and remembers their appearance. The blind man hears them, and retains the memory of their sound. Each is able to think in terms that the other is totally unable to comprehend.

A person possessed of all the different senses is able to experience sensations of every type. It does not follow, however, that he can *think* equally well in all types of mental imagery. The different memories are not equally developed. Most people are practically devoid of imagery for taste and smell; some have little memory for sights and sounds. In remembering the ocean, one man sees the waves as they break upon the shore; another hears them; a third may feel the damp spray as it is blown into his face; and still a fourth may smell seaweed and brine. One man is *eye-minded*, thinking in terms of sight; another is *ear-minded*, thinking in terms of sound; still another is *motor-minded*, thinking in

¹ James, "Principles of Psychology," Vol. II, p. 205.

terms of muscular movements. The eye-minded man is called a *visile*, *visuel*, or *visionaire*; the ear-minded man, an *audile*, *auditeur*, or *auditaire*; the motor-minded man is a *motile*, *moteur*, or *motaire*. There is also a type called the *tactile*. This type is found perhaps almost exclusively among the blind. The person of the mixed type, the *indifferent*, thinks equally well in any form of mental imagery.

The visile remembers best that which he sees; the audile, that which he hears; and the motile or tactile, that which he feels. Actors have different ways of learning their parts. One reads his part from the printed page, and learns through the visual imagery; another has the part read aloud to him, and relies upon his acoustic memory; still a third writes his part, and depends upon his visual and motor memories; or he may read the part aloud, and recall the words by their sound and feeling. To test the spelling of a word, one man mentally repeats the letters or utters them aloud. He judges of the accuracy by sound. Another must see the word in writing, or must "picture" the written word before him. A third executes the writing movements before he is sure of the spelling. After a tedious train journey the visile sees the different incidents of his tiresome ride; the audile hears the clangor and rumble of the train; and for hours the motile may feel its swaying.¹

¹ This last memory is, strictly speaking, not in kinæsthetic

The different image-types are not mutually exclusive. The visile does not think solely in visual imagery; his visual imagery merely predominates. In some cases, however, the thought-processes are conducted almost exclusively in the predominant form of mental imagery.

Not only is the prevalent image-type different with different persons, but in persons with the same type of mind the prevalent images may differ in intensity. Of two visiles, one will have optical images that differ little from sensations of sight, the other will have images that are rudimentary and schematic. In some cases the images are highly colored; in others, they appear only in light and shade. In the same person the mental imagery may vary greatly with the physical condition. Frequently the visual imagery becomes intense and highly colored during physical or mental fatigue. The perspicuity of visual imagery in isolated cases is demonstrated by feats of blindfold chess-playing. Some experts will, when blindfolded, conduct as many as sixteen or twenty games simultaneously, and win a majority of them. Each board, with the position of its men, must be clearly visualized; and as the player goes from board to board, he must remember the groupings of the pieces as he terms. The images are of static sensations, — sensations derived from movements of the whole body rather than of parts of it. These particular images seem to be particularly strong, however, in some motiles.

left them. A couple of such experts can conduct an imaginary game as they walk upon the street. Some artists find their visual images so distinct that they can dispense with their models after a single sitting.¹ Vivid mental images frequently border upon hallucinations. Galton says :

“A well-known frequenter of the Royal Institution tells me that he often craves for an absence of visual perceptions [images], they are so brilliant and persistent.”²

Galton conducted systematic inquiries into differences in mental imagery. He requested his subjects to describe, among other things, their memory of the breakfast table. This question has now become classical. The two following reports, taken “from returns, furnished by 100 men, at least half of whom are distinguished in science or in other fields of intellectual work,” illustrate the extremes of brilliancy and obscurity in visual imagery :

“Thinking of my breakfast table this morning, all the objects in my mental picture are as bright as the actual scene.”³

The second report runs :

“My powers are zero. To my consciousness there is almost no association of memory with objective visual impressions. I recollect the breakfast table, but do not see it.”⁴

¹ See Ballet, “Le langage intérieur et l’aphasie,” 2d ed., pp. 36-37.

² “Inquiries into Human Faculty and its Development,” p. 97.

³ *Loc. cit.*, p. 89.

⁴ *Loc. cit.*, p. 92.

James quotes the following introspective descriptions by two of his psychology students:¹

“‘This morning’s breakfast table is both dim and bright; it is dim if I try to think of it when my eyes are open upon any object; it is perfectly clear and bright if I think of it with my eyes closed. All the objects are clear at once, yet when I confine my attention to any one object it becomes far more distinct. — I have more power to recall color than any other one thing: if, for example, I were to recall a plate decorated with flowers, I could reproduce in a drawing the exact tone, etc. The color of anything that was on the table is perfectly vivid. — There is very little limitation to the extent of my images: I can see all four sides of a room, I can see all four sides of two, three, four, even more rooms with such distinctness that if you should ask me what was in any particular place in any one, or ask me to count the chairs, etc., I could do it without the least hesitation. — The more I learn by heart the more clearly do I see images of my pages. Even before I can recite the lines I see them so that I could give them very slowly word for word, but my mind is so occupied in looking at my printed image that I have no idea of what I am saying, of the sense of it, etc. When I first found myself doing this I used to think it was merely because I knew the lines imperfectly; but I have quite convinced myself that I really do see an image. The strongest proof that such is really that fact is, I think, the following:

“‘I can look down the mentally seen page and see the words that *commence* all the lines, and from any one of these words I can continue the line. I find this much easier to do if the words begin in a straight line than if there are breaks.’”

The second description gives the other extreme in visual imagery:

¹ “Principles of Psychology,” Vol. II, pp. 56 f.

“‘My ability to form mental images seems, from what I have studied of other people’s images, to be defective, and somewhat peculiar. The process by which I seem to remember any particular event is not by a series of distinct images, but a sort of panorama, the faintest impressions of which are perceptible through a thick fog. — I cannot shut my eyes and get a distinct image of anyone, although I used to be able to a few years ago, and the faculty seems to have gradually slipped away. — In my most vivid dreams, where the events appear like the most real facts, I am often troubled with a dimness of sight which causes the images to appear indistinct. — To come to the question of the breakfast table, there is nothing definite about it. Everything is vague. I cannot say *what* I see. I could not possibly count the chairs, but I happen to know that there are ten. I see nothing in detail. — The chief thing is a general impression that I cannot tell exactly what I do see. The coloring is about the same, as far as I can recall it, only very much washed out. Perhaps the only color I can see at all distinctly is that of the table-cloth, and I could probably see the color of the wall-paper if I could remember what color it was.’”¹

The following account, from another source, shows strong auditory and tactile imagery:²

“‘In recalling a fire which I witnessed I can hear the church bells ringing out the alarm, and can plainly distinguish between the deep tones of one and the higher pitch of the other. All the confusion of sounds now comes to me — the shouting from different quarters of the town, the sound of footsteps on the board sidewalks, even the sound of my own breathing and puffing and of those running by my side. I have no really distinct

¹ James, *loc. cit.*, p. 57.

² Scott, “Psychology of Public Speaking,” pp. 26 f.

vision of the fire itself, but can hear the cracking of breaking glass, the peculiar roar of a huge blaze, and the excited voices of the crowd. The picture is one of confusion, and noise predominates. I can easily see in imagination the faces of my acquaintances, but it is easier to hear their voices. In playing accompaniments to mandolin pieces upon a guitar, I derive almost the same amount of pleasure whether the other instruments are present or not. My imagination supplies all the absent parts. I can accompany and hear an air which is too difficult for me to render on a piano or by whistling; in my imagination every note is vivid. As for images of touch, they are most vivid to me when I hear or listen to accounts of surgical operations. If such accounts refer to a broken leg, there is a painful sensation in that part of my anatomy, and I fear to step with that leg lest I hurt it. If I see a fly crawling on any one, I have an intense desire to brush it off, and feel relieved if I rub my face vigorously in the corresponding part."

The next report (a reply to definite questions) shows extremely weak acoustic imagery:¹

"I am not able to state whether I hear the train or not. I am inclined to think that it is a noiseless one. It is hard for me to conceive the sound of a bell, for instance. I can see the bell move to and fro, and for an instant seem to hear the ding-dong, but it is gone before I can identify it. When I try to conceive of shouts, I am like one groping in the dark. I cannot possibly retain the conception of a sound for any length of time."

Wilfred Lay describes his own auditory imagery in the following terms:²

¹ Scott, *loc. cit.*, p. 24.

² "Mental Imagery," *Psychological Review*, Monograph Supplement No. 7, p. 36.

"I find the auditory mental imagery in my case to be almost as important a factor in my mental life as is the visual, being a mental reproduction of the sounds I have heard — musical or otherwise. They are comparable with real sounds not so much in intensity, but perfectly with timbre, pitch, and duration. I can estimate a minute with much greater exactness mentally, if I listen to the auditory mental imagery of a piece of music which takes about a minute to perform."

The present writer can report the converse in auditory imagery. Apart from an auditory-motor memory for words (in which the auditory element is signally weak) he has no memory for sound whatever.

The motor memory has been a good deal neglected by psychologists, — probably because vivid motor imagery is somewhat rare, and fugitive images are difficult to introspect. The subjoined account gives a description of clear motor memory:¹

"My mental imagery seems to be of the motile type, strongly characterized by a sense of position and direction. My visual images are poor. I can only obtain the visual image of a familiar face by successively giving my attention to the separate features; the whole face does not appear to my mind. A word is indelibly fixed in my mind if I trace its characters on the palm of my left hand with the forefinger of my right. The mention of an author or a book brings up the position which that work occupies on the shelves with which I am familiar, but does not call up the looks of the surroundings. The idea of the cardinal points of the compass never leaves me, though

¹ Scott, "The Psychology of Public Speaking," p. 25.

it is frequently a mistaken one. In the city of Chicago my only guide is this sense of direction, which seldom leads me astray. I doubt my ability to locate by streets or by adjacent structures, the buildings with which I am most familiar. Words representing things that I have seen always give me a sense of their direction and position. Other words are invariably associated with the feeling of articulating them. In the act of writing, each letter is mentally pronounced. Among my early memories is one of firing a revolver. I remember pulling the trigger, but not the report that followed.”

Galton mentions the circumstance of a young Indian's following the outline of a drawing in the *Illustrated News* with the point of his knife, in order, as he explained, that he might “remember the better how to carve it when he returned home.”¹ Obviously he was resorting to his motor memory.

The motor memory appears to be weak in the majority of persons. Bastian, in the following lines, attests the feebleness of his own kinæsthetic imagery :

“Let him [the reader] close his eyes, and with pen in hand make movements in the air as though he were writing the word ‘London.’ He may thus assure himself that he has a set of sensations accompanying these movements. After an interval, say the next day, let him again close his eyes, and, without making any movement, attempt to recall ‘in idea’ the muscular and other sensations he previously experienced when writing the above-mentioned word. Let him then contrast his comparative powerlessness in this direction, with his ability to recall

¹ “Inquiries into Human Faculty and Its Development,” p. 97.

in idea the visual appearance of this word when written or its corresponding sound.”¹

The comparative powerlessness to recall kinæsthetic impressions has no existence for the motile. The present writer, whose motor images are extremely vivid, can recall these movements with the utmost facility, but he finds it difficult to recall the visual or auditory image. The writer well remembers that, long before he knew anything of mental imagery, he would practise pieces on the piano by performing the more difficult passages in kinæsthetic imagery of finger-movements. He could play from memory; though this memory was purely visual and motor, the auditory musical imagery being non-existent. The writer takes an amateur's interest in card tricks. Recently he was acquiring some new sleights of hand, and frequently practised them in motor imagery while walking in the street.

Sufficient has been said to show that there is a great diversity in individual minds; that human minds are, in fact, as different as human faces. There is a difference both in the type of imagery employed, and in the intensity of the imagery itself. With some persons a particular form of memory may never develop: there is congenital amnesia. Olfactory and gustatory amnesia are too common to be abnormal.

¹ “Aphasia and Other Speech Defects,” p. 10.

Musical amnesia, too, occurs with the greatest frequency. It is recognized as the lack of a "musical ear." Auditory amnesia (for the more ordinary physical sounds) is congenital in many persons. Visual amnesia is more rare, but, as James says, "some people undoubtedly have no visual images at all worthy of the name."

As regards the difference in intensity, Galton has established the fact that men of science, or, in general, men eminent in the field of intellectual work, are strikingly deficient in visualizing powers. — Vivid mental pictures would be likely to divert the attention in abstract thought. These images probably become vestigial because the thinker attends to the relations between them, and ceases to regard them for their content. To a considerable extent visual images are supplanted by verbal thought. — Galton further ascertained that "the power of visualizing is higher in the female sex than in the male," and that it is stronger in children than in adults.

More extensive inquiries would probably have elicited the fact that *auditory* imagery is more prominent in females. There appears no *a priori* reason why the greater intensity should be limited to one particular class of mental imagery. There seems to be a correlation, as regards intensity, between the different forms of mental imagery. From inquiries among 125 artists and sculptors (who must per-

force have strong visual imagery) Lay found that 92 per cent could recall music with sufficient clearness to derive pleasure from the imagery. Sixty-eight per cent derived pleasure from the memory of fruit — presumably from the gustative memory. These percentages are sufficiently high to suggest the correlation mentioned. The greater clearness of the mental imagery in the female sex would readily account for woman's greater conversableness, the more intense verbal imagery finding a more ready expression in articulate speech. The same phenomenon would account for the earlier acquisition of speech by girls.

The clearness of mental imagery is by no means correlated with the keenness of sense-perception. A person may have little visual memory, but still be quick to recognize faces. He may have no memory for colors, but may be able to distinguish the finest differences of shade. He may be devoid of auditory imagery, and yet readily recognize voices. He may possess not a vestige of musical memory, and yet have a keen appreciation for music. Furthermore, there is no essential connection between the imagery of the waking state and the imagery of dreams. One may be ordinarily destitute of auditory imagery, and yet dream in terms of sound. During illness, such a person may have hallucinations or pseudo-hallucinations of hearing. •

Among the curiosities of mind are certain bizarre associations of mental imagery. This associational process is known as *synæsthesia*. Many people, when listening to music, associate the tones with mental images of color. Thus a veritable kaleidoscopic performance goes on in the mind. This particular form of association is known as *color-audition*, or *chromæsthesia*. Other people associate colors with tastes. Yellow may be salt; green, acid; red, peppery; etc.

Many persons employ mnemonic devices, known as *number-forms*, in recalling numerals, days of the week, months of the year, etc. When they think of a date or hear one mentioned, they immediately associate it with its particular position on a "visual" calendar. Hours of the day are associated with the position of the hands on a "visual" timepiece. These associations are invariable in the same person, but are seldom alike in two different people. They occur more frequently in females than in males, and are more common among children than among adults. Usually they have existed too far back for the memory to determine their origin.

"Traces of the origin of the Forms that appear here and there are dominoes, cards, counters, an abacus, the fingers, counting by coins, feet and inches (a yellow carpenter's rule appears in one case with 56 in large figures upon it), the country surrounding the child's home, with its hills and dales, objects in the garden (one scientific man sees the old garden walk, and the nu-

meral 7 at the tub sunk in the ground where his father filled his watering pot). Some associations seem connected with the objects spoken of in the doggerel verses by which children are often taught their numbers.”¹

In his “Inquiries into Human Faculty” Galton gives nearly seventy illustrations — many of them in colors — representing different mnemonic devices. The following is one of the descriptions showing associations between numerals and colors:²

“Up to 30 I see the numbers in clear white; to 40 in gray; 40-50 in flaming orange; 50-60 in green; 60-70 in dark blue; 70 I am not sure about; 80 is reddish, I think; and 90 is yellow; but these latter divisions are very indistinct in my mind’s eye.”

In another case the numerals from 1 to 9 appear in different colors: 1 is black; 2, yellow; 3, pale brick-red; 4, brown; 5, blackish gray; 6, reddish brown; 7, green; 8, bluish; 9, reddish brown, “somewhat like 6.” The colors are very distinct when the numbers occur separately. In compounds they are less clear. For historical dates the numbers appear upon a colored background that resembles the particular hue of the principal figure indicating the century.

In many cases the letters of the alphabet, particularly the vowels, are invested with color. This subject will recur in the final chapter.

¹ Galton, “Inquiries into Human Faculty and Its Development,” p. 128.

² *Loc. cit.*, p. 141.

CHAPTER III

THE VERBAL IMAGE

A LANGUAGE is any system of symbols used primarily for the expression of thought. The symbol is the nucleus of a concept. When used as a means of communication, it is intended to make known — by means of its associations — the thought passing in the mind of the person employing it. Language is not necessarily speech. We have a written language, a language of gestures, a manual language, and so on. Had we lived in a world with no enveloping atmosphere, it would have been impossible for the evolving race to communicate by means of acoustic symbols; that is, by vocal speech. With no air to convey sound-waves, there would have been no sense of hearing. For communication, the race must perforce have resorted to the only other distance-receptor available, — the sense of sight. There would then have developed a complex language of gestures, or perhaps a manual or a labial language. Sight and feeling would be the only two senses involved.

It has been shown in Chapter I that the concept-nucleus may be almost any mental image whatever.

With the deaf-mute, the nucleus may be a visual or kinæsthetic image of certain finger-movements. With the deaf-blind, the language-concept is still further limited; it is a tactual or motor representation of finger-movements. These cases are admittedly exceptional. They are cited to emphasize the fact that language is not necessarily represented in the mind by auditory memory-images of spoken words.

In this chapter, spoken language will be the chief subject of consideration. Spoken language does not, however, involve merely the sense of hearing. Words are distinctly *felt* as they are uttered: the movements of the lips, tongue, and larynx are as much a part of the verbal concept as are the sounds that these movements produce. Further, these oral movements can be *seen*. Lip-reading becomes an accomplishment among the deaf, and for the interpretation of speech the sense of sight serves them almost as well as would the sense of hearing. Spoken language, then, may involve the three senses of hearing, feeling,¹ and vision; and the mental representation may be in terms of mental images pertaining to any one of these senses. In normal cases, vision naturally plays no conspicuous part.

The matter becomes slightly more complex when written language is considered in addition to spoken language. In the act of writing, both kinæsthetic

¹ Accepting *feeling* for the time being as a unitary sense.

and visual sensations are present. In the act of reading, vision alone is involved.

From the above discussion it is evident that the verbal image may be represented in any one of a variety of elemental forms, or that it may subsist in the mind as a complex of several elementary images. With the educated person there is, in addition to the auditory and kinæsthetic images of the spoken word (with occasionally a visual representation), a visual and a motor image of the written symbol. It was shown in Chapter II that different types of images are present in different minds with varying degrees of prominence. Thus it is naturally to be expected that there should exist different types of verbal thought with different persons, — that the audile should think of the sound of the word, the motile of its feeling, and the visile chiefly of its graphic representation. It is seldom, of course, that one type of imagery prevails to the exclusion of all others. In the audile, hearing predominates; in the *articulomoteur*, the memory of feeling is preponderant; in the *audito-moteur*, the two elements may be equally conspicuous.

People of the visual verbal type are rather rare, yet —

“Some few persons see mentally in print every word that is uttered; they attend to the visual equivalent and not to the sound of the words, and they read them off usually as from a long imaginary strip of paper, such as is unwound from tele-

graph instruments. The experiences differ in detail as to size and kind of type, color of paper, and so forth, but are always the same in the same person.”¹

These visual images appear also in silent thought, but they are more in evidence when the subject is speaking, or is listening to the words of another person. Frequently the words appearing before the mind are written instead of printed.

In silent thought the words are, as a rule, mentally pronounced. But this is not invariably the case; sometimes the appreciation of the word is *purely* visual. One may read printed words in much the same way as he would read Indian picture-writing or Egyptian hieroglyphics; *i.e.* without necessarily having recourse to spoken words or their memory-images. The reading of a foreign language is often largely visual where knowledge of it happens to be deficient; though the average person would, of course, improvise a pronunciation that would serve all the purposes of the most exact verbal imagery. In reading numbers or foreign names, the appreciation is often entirely visual. Few persons would stop to bestow more than a schematic pronunciation upon such a word as *Nizhn-Udinsk*. Still fewer would accord the full titular dignity to such a number as 6,328,087,628,041; its value — like that of a number

¹ Galton, “Inquiries into Human Faculty and Its Development,” p. 97.

expressed in Roman numerals — would be understood in a general way without being interpreted in words. Similarly the visile understands his mental words without pronouncing them. He thinks much as the deaf-mute reads; that is, by associating the printed word directly with the images that give it meaning. But, as already stated, the visile usually pronounces his words mentally after they have appeared in the visual form. The process merely starts with the visual image, and is consummated when the word is mentally heard or spoken.

In exceptional cases words may present themselves to the visile as optical images of articulative movements. This type of verbal memory is present to an extent among the congenitally deaf that have learned oral speech by sight and feeling. The visual images, however, are accompanied by memories of feeling, which undoubtedly play a prominent part in verbal thought.

The mental hearing or mental pronouncing of a word represents the most common type of verbal imagery. The average person would testify without a moment's hesitation that, when he thinks in words, he hears the words in his mind. In most cases the statement would be true; but in most cases, too, it would represent but a part of the truth. The average person *feels* his words just as much as he hears them. His verbal image is a complex. This is especially

true when verbal thought is about to find expression in speech. It will be best to treat the matter systematically and to show: first, that the verbal imagery may in some cases be purely auditory; secondly, that in others it may be purely kinæsthetic; and thirdly, that with most persons it is composite, being both kinæsthetic and auditory.

To begin with the pure auditory image: As there exists an auditory memory for music and the commoner physical sounds, so there exists a purely auditory memory for spoken words. The evidence in support of this fact is conclusive. An audile will occasionally hear a number of voices simultaneously. Manifestly, such verbal imagery could not subsist in kinæsthetic terms: it is heard; it could not possibly be felt. Occasionally the subject imagines that he is himself speaking in concert with a number of other people. In this case his own speech may be kinæsthetically represented, but the speech of the other persons must be purely auditory. The writer recently had an experience of this kind during a dream. He was listening to the excellent singing of a chorus of about thirty voices. Occasionally his own voice would intrude, much to the detriment of the melody. The singing of the chorus was purely auditory;¹ the voice of the writer was auditory-motor.

¹ With the writer, no such auditory imagery appears during the waking state.

As further evidence that verbal imagery may be purely auditory, we have the testimony of some psychologists that they *hear* their words when they think. Egger says,¹ "My internal utterance is an imitation of my voice." In another passage he compares mental language to an echo. Bastian² finds that his verbal imagery is chiefly auditory, and that the kinæsthetic images of words are scarcely recoverable. Titchener³ quotes the following introspective description of auditory verbal imagery: "'The *R* seemed to ring through my head. Letters came by sound; I did not speak them.'" Many people have auditory images of words during the primary memory. As they listen to the *after-sensation*, or *mental-echo*, of words they have just heard pronounced, they hear them "ringing in the head."

As further evidence that verbal memory is often in acoustic terms, we have the fact that many people lose all memory of words when that brain-centre is destroyed in which auditory memory resides.⁴

And now for the kinæsthetic imagery. What proof have we of its importance? It has sometimes been argued that, since the deaf child remains dumb because of lack of hearing, the auditory imagery must

¹ "La parole intérieure," 2d ed., p. 67.

² "Aphasia and Other Speech Defects" and "The Brain as an Organ of Mind."

³ "Experimental Psychology," Part II, Vol. I, p. 399.

⁴ The subject of brain-centres will be discussed in the next chapter.

necessarily be the most important element in verbal thought. The argument is fallacious. Even the person possessed of hearing may have practically no secondary auditory memory, — yet he thinks in words and speaks with perfect fluency. During the learning-process, in such cases, the child uses his kinæsthetic and primary auditory memories; or he may use hearing merely as a guide, learning chiefly by feeling and correcting himself by ear. In either case the words are remembered in terms of feeling; that is, in kinæsthetic imagery.

The child that is born deaf would never learn to speak, or think in words, if internal language were entirely dependent upon auditory memory. However, the child *is* taught to *speak* with considerable fluency by using sight and feeling as guides. The words are then remembered largely in terms of feeling. Educated deaf people learn to speak with such fluency, and to read the lips of other speakers with such readiness, that in many cases their conversation gives no evidence of their infirmity. In the following words Kussmaul describes a conversation he had with a deaf person that had been orally taught:¹

“One day I was engaged in conversation in the hospital for a considerable time with an intelligent young bookbinder, who was suffering from phthisis, without noticing anything

¹ “Störungen der Sprache,” 4th ed., p. 54.

abnormal in his speech except a loud voice and an unusually measured and careful utterance. It was not till I had finished the examination and taken my report of the case, that I learned to my astonishment that I had before me a person that was absolutely deaf.”¹

In such cases as this, words are remembered in visual and kinæsthetic terms. There may be visual images of the movements of the lips and tongue; but the action of the larynx, pharynx, soft palate, etc., must in memory be “felt.” These organs cannot well be observed during speech; hence their action cannot be visually remembered. Visual images are not even necessary. Sight may be used merely as a guide during the learning-process, and the words may be retained only in terms of feeling. Helen Keller, who was both blind and deaf, managed to master speech solely by the sense of feeling. It is evident that her words must be retained solely as kinæsthetic images.²

¹ The speech of the educated deaf is usually lacking in proper accentuation and inflection, — elements of speech that are not readily *felt*. There is a somewhat impartial distribution of stress; thus the enunciation comes to resemble that of French, in which articulation is vigorous and stress inconspicuous.

² Miss Helen Keller was deprived of sight and hearing at the age of nineteen months. Some years later she was taught to speak “by feeling.” In spite of her disabilities she managed to acquire a thorough education. She graduated from Radcliffe College with the degree of Bachelor of Arts in 1904. Miss Keller has on several occasions spoken from the public platform. See her “Story of my Life,” New York, 1908.

Among normal persons, the motile may remember his words almost exclusively in terms of feeling. If he happens to be deficient in auditory and visual memory, there is no other way in which he *can* remember them. Speaking of his mental words, Dodge says: ¹

"I *spoke* them. They were rudimentary, and for the most part indistinct."

And again: ²

"It is just as though I spoke the words — except for the fact that the acoustic element is lacking. Often there are actual movements of the lips and tongue. More frequently I am uncertain whether these have taken place. In no case were visual images or images of writing-movements detected. Acoustic images were just as little in evidence. The words had neither timbre, pitch, nor acoustic intensity. However, they were not mere skeleton-words, such as pure movement-images would represent; they possessed on the contrary a certain fulness that distinguished them in a characteristic manner from other memory-images of simple mouth-movements."

On a later page he says: ³

"I am able to imagine quite clearly the movements that I make in producing certain sounds, and I can analyze their separate elements. Nevertheless, what is analyzed is certainly not auditory imagery."

His verbal thought is not represented by visual images of printed words, for according to the author's

¹ "Die Motorischen Wortvorstellungen," p. 10.

² *Loc. cit.*, pp. 11-12.

³ *Loc. cit.*, p. 34.

account his visual images are inadequate for this purpose :

"It is easy for me to command clear optical images of printed or written letters. I can even visualize small groups of letters, or short words. This faculty for visualizing with uniform clearness ceases with words of four or five letters. I cannot always picture four letters at once with uniform distinctness. When the words are longer, I get a general picture — more or less distinct — in which the letters become clear in quick succession. It is not meant that a single letter becomes clear and then totally disappears, but rather that a small group of letters grows clear in the confused picture, fading again as another group rises into view. The speed of this emergence is determined by the audible or silent speech. The emergence itself usually takes place in syllables." ¹

It is evident from this account that Dodge does not rely on his visual memory of words, but that his verbal memory is purely kinæsthetic.

Another writer, Stricker, describes his verbal imagery as being purely kinæsthetic. He compares himself when engaged in silent thought to a pianoplayer that runs his fingers over the keys without actually striking them. The thought is portrayed in movement, not in sound.² He says of an imaginary conversation :

"I speak first for myself in motor word-images; then I reply for the other party — also in motor word-images." ³

¹ *Loc. cit.*, p. 15.

² "Studien über die Sprachvorstellungen," p. 16.

³ *Loc. cit.*, p. 93.

Stricker's *primary* auditory memory seems to be clear, for he says :

"Immediately after a stranger has spoken to me, I can easily recall his voice and the words that he uttered. This memory gradually fades. The words remain in my memory; but not always the voice. For instance, I can recall the exact words with which a beggar accosted me in ~~the~~ street a few days ago; I can recall his appearance, but I have not the faintest memory of his voice."¹

Stricker's secondary memory is apparently purely kinæsthetic; for he says of it

"When I close my eyes to assist concentration, and allow some verbal thought to pass through my mind, a familiar verse, for instance (and ignore meanwhile specific occasions upon which I have heard it); then I seek in vain for any memory of sound that attaches itself to the words."²

With Stricker, distinctions between similar words are *felt*, and not heard, for he says :

"Despite the manifold differences displayed by the letters *B*, *P*, and *M* when they are actually pronounced, I find no difference in them in thought but the characteristic labial feelings. No matter how carefully I examine the words 'pater' and 'mater' in silent thought, I find that the only difference between them is the feeling of the *p* or the *m*."³

Stricker, like Dodge, does not think in visual images of words. His verbal memory is almost exclusively kinæsthetic.⁴

¹ *Loc. cit.*, p. 19.

² *Loc. cit.*, p. 19.

³ *Loc. cit.*, p. 10.

⁴ *Loc. cit.*, p. 20.

The above introspections furnish convincing evidence in support of a purely kinæsthetic verbal memory. If further evidence were necessary, it could be found in the characteristics of certain pathological cases. One or two of these will be cited in a later chapter. In such cases, which are admittedly rare, it is found that the patient retains command of verbal thought and speech despite the fact that the brain-centre is destroyed in which the auditory word-images were stored. It is obvious that the word-memories can remain only in terms of feeling. The patient is an *articulo-moteur*.

But the average person is neither an articulo-moteur nor an audile. He is an *audito-moteur*, and his verbal imagery is of the mixed type. In recalling words, he both feels and hears them. This fact is convincingly demonstrated by the various speech-disturbances that follow the destruction or impairment of either of the brain-centres that preside over the kinæsthetic and auditory verbal memories. When *either* of these centres is destroyed, internal language is usually impaired. When only the auditory centre is impaired, the patient often utters unintelligible gibberish (jargon-aphasia). If his verbal memory had been purely auditory, he would have become mute. If it had been purely kinæsthetic, his language would have remained unaffected. But the fact that his speech becomes distorted shows conclusively that the

kinæsthetic centre is acting without the directory influence of the auditory centre. These facts show that the coöperation of *both* centres is usually requisite for normal internal speech. The matter will be better understood after a perusal of the two succeeding chapters.

Introspection reveals the presence of both the motor and auditory elements in the average person. Among nearly a hundred persons, Stricker found only *one* that was conscious of no feeling in the lips when mentally pronouncing the letters *M*, *B*, and *P*. Among nearly sixty, only two failed to detect these feelings when reading.¹ The average audito-moteur is unable to think the explosive and labial consonants clearly when the mouth is open and the tongue protruded. The unnatural position of the articulative organs seems to obstruct the incipient movements that accompany articulation. Such words as *bubble*, *wobble*, *toddle*, *mimicry*, *kindergarten*, etc., then appear thick and unnatural, — as though one were speaking them with the lips apart.²

With many audito-moteurs the motor tendency is so pronounced that actual movements of the speech-organs occur during silent thought, and in exceptional cases people may talk aloud instead of thinking to themselves.

¹ *Loc. cit.*, p. 49.

² The difficulty disappears if the test is long continued.

Concerning the articulatory tendency Bain says:¹

"When we recall the impression of a word or sentence, if we do not speak it out, we feel the twitter of the organs just about to come to that point. The articulating parts — the larynx, the tongue, the lips — are sensibly excited; a *suppressed articulation* is in fact the material of our recollection, the intellectual manifestation, the *idea* of speech."

And thus Wyllie:²

"I find, when I mentally sing a song, with or without its words, that it is impossible to prevent my *pomum adami* from moving upwards when the melody passes into its highest notes; but at the same time, I am most clearly conscious of the varying pitch and cadence of the internal voice."

The present writer can distinctly feel the movements of the larynx when thinking a vowel with rising inflection. The auditory image, however, is weak. After thinking the vowel for a minute there is a distinct aching in the larynx, due beyond doubt to the tension of the vocal cords. The writer has experienced the same aching sensation in the larynx after conversing for a quarter of an hour with a man that was compelled by a throat affection to whisper.

This last phenomenon gives proof of sympathetic movements during the act of listening. Many psychologists have described this inchoate articulation. Thus Stricker, for instance:³

¹ Bain, "The Senses and the Intellect," 4th ed., p. 357.

² Wyllie, "Disorders of Speech," p. 237. ³ *Loc. cit.*, p. 49.

"I noticed these feelings first of all in the lips when any one read to me with clear articulation. Each *M*, *P*, or *B* of the speaker was accompanied by these labial feelings. Soon afterwards I noticed that, when listening to clearly articulated speech, I followed each word with an internal articulation of my own."

Stricker finds further evidence of this concomitant articulation in the fact that he remembers words long after he has forgotten their sound.

Bain also makes reference to these sympathetic speech-movements :

"While intently listening to a speech, we are liable to follow the speaker with a suppressed articulation of our own, whereby we take the train of words into a vocal embrace, as well as receive it passively on the sense of hearing."¹

The foregoing arguments should establish the practical universality of the motor tendency in internal speech. Internal audition is, however, no less prevalent. Just as Stricker has found by inquiry that ninety-nine persons in a hundred are conscious of the motor tendency in silent speech, so the present writer has ascertained that no less a proportion are clearly conscious of internal audition. However, this fact receives general recognition; it would be supererogatory to argue in favor of it. Even Stricker and Dodge are not entirely devoid of auditory imagery. The latter says of his aural memory :

¹ *Loc. cit.*, p. 371.

"In an imperfect manner I am able to reintegrate auditory images. I can give my verbal images the timbre of my father's voice, — but this only with difficulty, and the attempts are often fruitless. A visual image of my father is an invariable prerequisite. I know, for instance, that my father has often employed the expression 'My boy' when conversing with me. But I find no trace of an auditory memory of my father's voice when I express the silent judgment, 'My father has often used the phrase, "My boy." ' Even with the greatest pains I cannot imagine the peculiarities of his voice. This is possible only when I have a definite visual image of my father, and imagine a specific occasion for his speaking." ¹

And again :

"Immediately after I have heard some one speak, I can recall his words with the greatest clearness. But these fade quickly, and usually no auditory memory remains. Similarly, it is difficult for me to obtain an auditory memory of my own voice. When I speak a word and attend especially to the auditory impressions, I am able for some time afterward to reproduce the acoustic image at will. But this ability disappears, too, after a while; and all traces of sound are soon lost in the imagery of movement." ²

The above paragraphs make it clear that Dodge is not entirely lacking in auditory imagery; though the imagery is obviously weak. Dodge gives it as his opinion that the fulness and roundness of his verbal images subsists not only in vibration-feelings in the larynx and thorax, but also in "a kind of unlocalized, evaporated auditory imagery" that be-

¹ Dodge, *loc. cit.*, pp. 15-16.

² *Loc. cit.*, p. 17.

comes only in exceptional circumstances a clear and independent reproduction.

Stricker, likewise, is not entirely destitute of auditory memory. He is sometimes able to recall a person's voice by first visualizing his figure, or by clearly imagining the circumstances under which particular words were spoken. The memory is then of words as uttered upon a particular occasion, rather than of words as having a specific meaning.

An important fact must be noted at this point: In recalling the voice of a particular person, the audiomotor does not necessarily resort to pure auditory imagery. Stricker's "open-mouth test" will show that the labial and explosive consonants are as much motor as ever. The characteristic timbre of the voice is represented only in the vowel; and it is this part of the word that is mentally *heard*. The writer finds that this is the case with his own imagery. He can on rare occasions recall the peculiar pronunciation that a certain Oriental friend accords to his name. But introspection shows that he is himself mentally pronouncing the word, and that the characteristic quality of the remembered voice is present only in the vowel of the last syllable. The case is similar with the primary memory. The word is present as an auditory-motor image; the consonants are distinctly felt, but the characteristic auditory element inheres only in the vowel.

From the foregoing arguments it should be clear that the average person is an *audito-moteur*. His verbal imagery is of the mixed type. When thinking silently in words, he both hears them and feels them.¹ If his acoustic memory is strong, he may have a sound-image of the entire word, and kinæsthetic images of only the grosser muscular movements; *i.e.* chiefly of the consonants. His verbal image will then have a binary, or dual, form. For consciousness, however, one image will be, as it were, superposed upon the other, and the images will appear to the mind as a unit — or, if introspection is keen, as a composite image. If, on the other hand, the acoustic memory is weak, there will be an auditory image of only the vowel. The consonants and grosser muscular movements of speech will be represented in kinæsthetic imagery, and the verbal imagery will in actuality be composite.² In either case the presence of the audi-

¹ There appears to be also an auditory-motor musical memory. Some people are unable to recall a tune without mentally humming it, singing it, or playing it upon a musical instrument. The sounds can be reintegrated only when they are associated with the kinæsthetic memory of specific movements. The movements are probably recalled first, the sounds being awakened by association.

² Various phenomena indicate that the word is normally represented in the brain by a plurality of cells. One may, for instance, remember the initial consonant of a word (in terms of feeling), but be unable to recall the word in its entirety. One may interchange the initial consonants of contiguous words and syllables (*achoppement syllabique*), etc., etc.

tory image will be required for normal verbal thought and normal oral expression.

The feeling-element of speech has in this discussion been treated as exclusively kinæsthetic. This has been done for the sake of simplicity. In reality, the feeling-element does not comprise merely the consciousness of muscular movement or muscular action, but it embraces in addition tactual sensations, — sensations of contact, friction, and the like. The fricatives, *f*, *v*, *s*, *th*, etc., are as much tactile in their representation as they are kinæsthetic. The matter is more readily understood by regarding the sensations rather than the mental images. In pronouncing the letter *f*, for instance, the only muscular movement involved (neglecting respiration) is that of bringing the lower lip into contact with the upper teeth. In this act one is conscious of the contraction of the labial muscles; but one is also conscious of certain characteristic cutaneous sensations. After the initial movement has been performed, there is practically no muscular activity in the articulative organs. There may be a slight tension in the muscles of the lower lip from which one could derive kinæsthetic sensations; but if the consonant is continuously produced, the more conspicuous sensations are undoubtedly tactual. The tactual impressions in this case consist of the sensation derived from the contact of the upper teeth with the lower lip, and the sensation

produced by the passage of the air through the labial aperture. It is evident, then, that a continuous *f* — since it occasions marked tactual sensations in actual enunciation — must be mentally represented largely in tactual terms. An *f* that is not continuously produced contains these sensations no less than one that is prolonged; there is a difference merely in duration. Similar arguments can be adduced in support of the tactual element in all the continuous consonants.

The explosive consonants involve a greater amount of muscular activity; but they contain, nevertheless, a marked tactual element. Taking the letter *b*, for example, we find that a tactual sensation is derived from the contact of the two lips. As the labial pressure is increased to resist the air-column, there is naturally an increased muscular tension giving rise to kinæsthetic sensations. But there is also an increased pressure by the air-column upon the inner surfaces of the lips, and this produces a characteristic tactual impression. The explosive consonants, then, as well as the continuous consonants, give rise to tactual sensations, and they are represented by tactual images in the mind.

There is no strict line of demarcation between the kinæsthetic and tactual elements. Kinæsthetic sensations may be regarded as tactual sensations from muscular, tendinous, and articular surfaces. They are *internal* tactual sensations, or tactual sensations derived exclusively from the muscular system.

CHAPTER IV

THE BRAIN

THE brain comprises the cerebrum and the cerebellum (or little brain). The cerebellum lies below the cerebrum, in the posterior part of the cranium. It stands in anatomical connection with the cerebrum and spinal cord. The cerebrum is divided by the median fissure into two more or less symmetrical hemispheres. It presents a surface characterized by numerous irregular furrows and convolutions. The cerebellum contains three definite lobes, of which the median lobe is rudimentary. To the naked eye the cerebellum presents a regular, laminate structure. The great mass of the brain consists of white matter, composed chiefly of fibres. There is a superficial layer of gray matter, two or three millimeters thick. This surface-layer — consisting chiefly of cells — is called the cortex.

The principal fissures of the cerebrum are the median fissure, the fissure of Sylvius, and the fissure of Rolando. These last two, with the parieto-occipital fissure, divide the external surface of the hemisphere ¹

¹ In discussing the fissures and convolutions, *one* hemisphere is taken for the sake of simplicity.

into its four principal lobes. These are the frontal, parietal, temporal, and occipital lobes, named after the bones of the skull to which they lie contiguous.

The frontal lobe comprises the first, second, and third¹ frontal convolutions,² and the precentral convolution, which lies just anterior to the Rolandic fissure. The temporal lobe embraces the ventral aspect of the hemisphere. It contains the first, second, and third¹ temporal convolutions. The occipital lobe comprises the first, second, and third¹ occipital convolutions, — in the posterior part of the hemisphere. The parietal lobe lies posterior to the fissure of Rolando. It contains the postcentral convolution, the superior parietal lobule, the supra-marginal gyrus, and the angular gyrus.

The mesial aspect of the hemisphere³ displays the marginal gyrus, the gyrus fornicatus, the hippocampal gyrus, the uncinate gyrus, and the quadilateral and cuneate lobules. The island of Reil, another small group of convolutions, is found at the bottom of the fissure of Sylvius.

The gray cortex of the brain follows each of the different folds and convolutions; thus the entire surface of the brain is composed of a layer of cells.

The cells of the cortex are in direct connection with the white fibres that compose the great mass of the

¹ Also designated *superior*, *middle*, and *inferior*.

² See Figure 1.

³ See Figure 2.

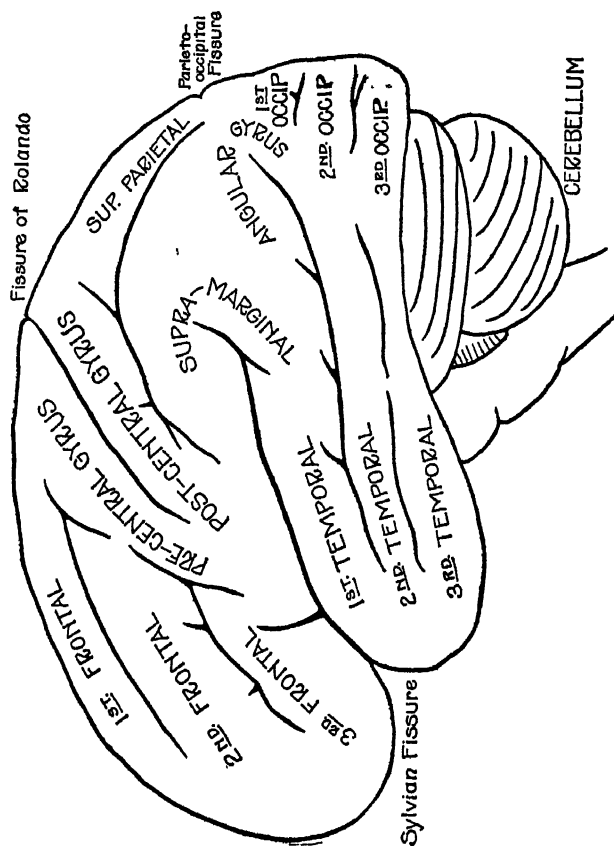


FIG. 1.—Diagram showing the left lateral aspect of the brain.

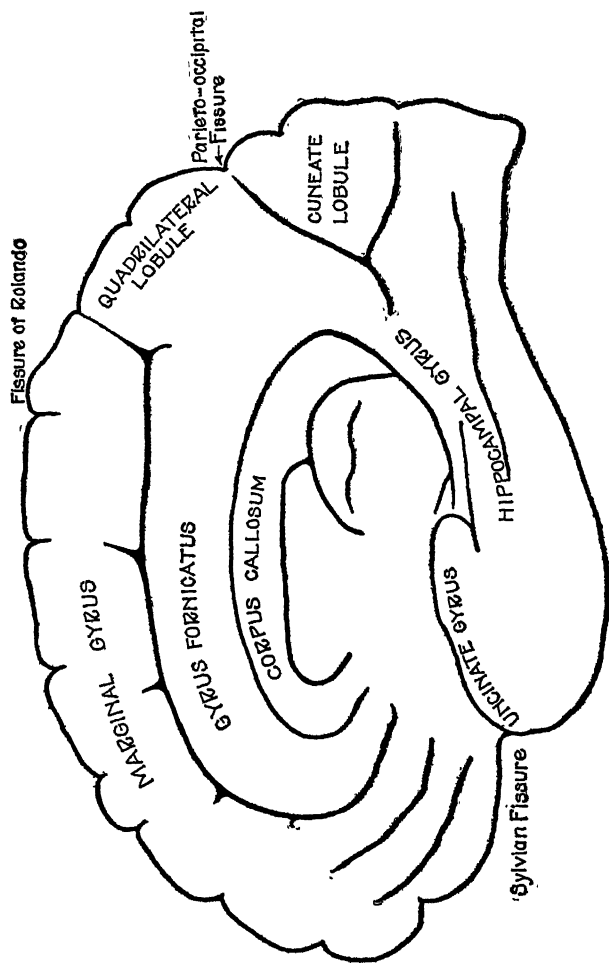


FIG. 2.— Diagram showing the medial aspect of the right cerebral hemisphere.

brain. The cell-body and its numerous filaments and ramifications constitute a functional unit, known as a neurone.¹ The brain consists simply of neurones, with the neuroglia — or supporting tissue — and a rich supply of blood-vessels. The filaments proceeding from the cell-body vary in length from the merest fraction of a millimeter to several feet, the longer fibres, of course, extending beyond the brain. The shorter filaments form connections between the different cells themselves (these are the association fibres), while the longer fibres convey stimuli from the sense-organs or carry impulses to the muscles. The fibres that convey the ingoing stimulus are known as sensory, or afferent, nerves. Those conveying the outgoing stimulus are known as motor, or efferent, nerves.

¹ Donaldson estimates that there are not less than three thousand million neurones in the central nervous system. (See "The Growth of the Brain.")

Figure 3 represents the cells of the cerebral cortex magnified 114 diameters (Ferrier, after Bevan Lewis).



FIG. 3.

Thus there are three distinct classes of nerve-fibres, — the association-fibres, the sensory fibres, and the motor fibres. The association-fibres may be subdivided into long and short unilateral fibres, and transverse fibres. The transverse fibres connect convolutions in the opposite hemispheres.¹ The long unilateral fibres unite cells in different convolutions of the same hemisphere. The short fibres connect cells that are practically contiguous.

There is a decussation of the sensory and motor nerve-fibres, so that the left hemisphere of the brain stands in connection with sense-organs and muscles of the right side of the body, while the right hemisphere of the brain is connected with the left side of the body. There is an exception in the case of the olfactory tracts. The case of vision is somewhat anomalous. The left half of each retina is in connection with the left hemisphere of the brain, while the right halves of the retinae are connected with the right hemisphere. Thus an injury to the visual area in the left cortex results in blindness to the left halves of both retinae; consequently there is an obliteration of the right field of vision.

As already stated, the muscles of one side of the body are connected with the hemisphere of the opposite side. The right hand is moved through the

¹ The principal band of transverse fibres is known as the *corpus callosum*. (See Fig. 2.)

activity of cells in the left cortex; the left hand is moved through the activity of cells in the right cortex. This principle holds good for movements that are executed unilaterally. Movements that are invariably executed bilaterally are represented in only *one* hemisphere of the brain.¹ This is true of the articulative movements concerned in speech. In right-handed persons, speech-movements are initiated from the left hemisphere. In left-handed persons, they are initiated from the right hemisphere.

This brings us to the matter of cerebral localization. It is found that the brain-cells controlling particular muscles of the body or subserving particular sense-organs are not scattered promiscuously throughout the cortex, but are localized in fairly well-defined brain-areas or convolutions. This fact has been demonstrated in a variety of ways. It has been established by experiments performed upon animals — usually monkeys. After the cortex has been exposed, different areas are electrically stimulated. It is found that stimulation of definite areas of the brain results in the contraction of definite muscles. Certain areas control the movements of the leg; others control the movements of the arm. These areas can be subdivided, and definite localities assigned

¹ This statement is capable of qualification. To avoid complication and irrelevant discussion the principle is stated without its restrictions.

for the control of the shoulder, forearm, hand, index finger, thumb, etc. The movements occur, of course, on the opposite side of the body. When the stimulus is applied to the area that controls the muscles of the face, the resultant movements are generally bilateral. The sensory areas have been determined by extirpation of different portions of the cortex. Excision of the occipital areas leads to blindness; destruction of the temporal areas induces loss of hearing. Ablation of a motor area, of course, results in paralysis of the related muscles.

Investigations upon animals have been confirmed by experiments performed upon human beings when the cortex has been exposed by injury. The motor areas can be determined by electrical stimulation. An injury or tumor in these same areas results in paralysis. An injury in one of the sensory centres results in blindness, deafness, or in loss of the images of sight or hearing, according to the seat of the damage.

The site of the sensory centres is further indicated by cerebral atrophy. If a child is born blind or deaf, his visual or auditory brain-centre never becomes functionally mature. In many cases atrophy or softening takes place in the centre affected. The location of the degenerated area indicates, of course, the seat of the sensory centre.

The site of the different cerebral centres has likewise been demonstrated by the embryonal method.

Different fibres acquire their myelin sheaths at different periods; thus they can be traced from the peripheral senses-organs to their termination in the cortex.

The general motor area of the brain is situated in the Rolandic region. Figure 4 shows on the human brain the various subdivisions of the motor area as ascertained by Beevor and Horsley through experiments on the bonnet monkey. The researches of some other investigators seem to indicate that the true motor area lies anterior to the Rolandic fissure, and that the region posterior to the fissure embodies the corresponding sensory areas for the reception of tactile, thermal, kinæsthetic sensations, etc. The opinion of physiologists is by no means unanimous on this point, and it is held by many that the region on both sides of the Rolandic fissure is sensory-motor, rather than motor on one side and sensory on the other. Investigation is difficult, since destruction of the sensory regions impairs the motor functions. Fortunately this matter does not vitally concern the discussions of the present monograph.

It will be noticed that the centre for the control of the oral and vocal mechanism is at the foot of the precentral and postcentral convolutions. In the orang-outang this centre appears to be confined to the precentral convolution. A similar localization is made by most physiologists in regard to human beings.

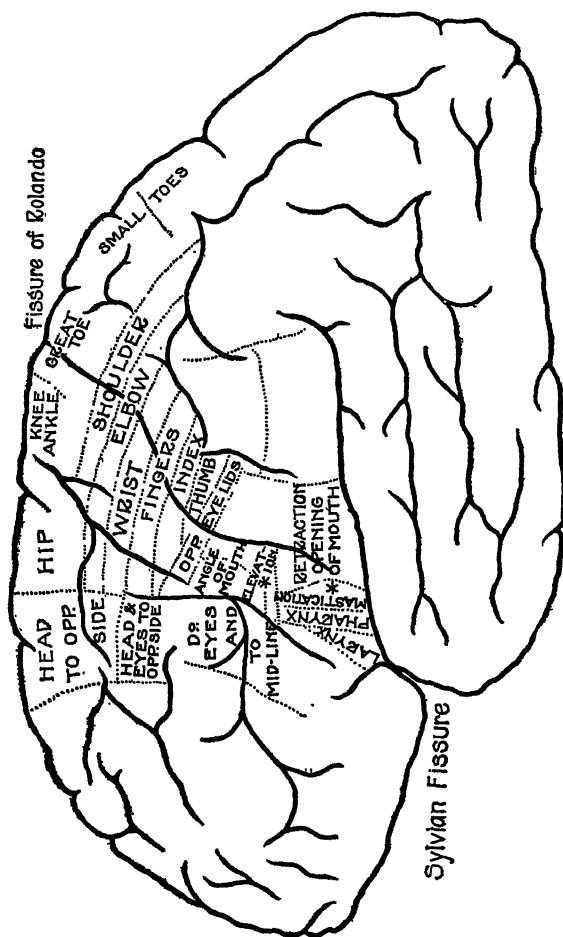


FIG. 4.— Motor areas of the brain (Gowers, after Beevor and Horsley). The asterisks indicate the centre for the tongue.

The subcentre for the oral articulative mechanism is supposed to lie posterior to that for the vocal mechanism. The motor fibres from the speech-centre pass to the motor centres in the medulla oblongata,¹ these centres being in direct connection with the organs of speech.

The region of the uncinate gyrus and hippocampal gyrus is regarded as the site of the olfactory and gustatory centres. The area for the reception of visual impressions is located in the occipital lobe, chiefly in the neighborhood of the cuneate lobule. The auditory area is found in the temporal lobe, especially in the first and second convolutions. Each of these "internal sense-organs"² stands connected with the peripheric sense-organ of the opposite side of the body. Both hemispheres of the brain are active during the reception of simple sensations of sight, hearing, etc.

The memory-centres³ are remarkable in that they are located in the left hemisphere of the brain in right-handed persons, and in the right hemisphere in left-handed persons. The reason for this phenomenon and for dextrality is somewhat of a biological mystery. Bastian has found that the specific gravity

¹ The bulb of the spinal cord, which lies within the cranium.

² With the exceptions stated on page 66.

³ By a *memory-centre* is meant a centre presiding over a particular type of mental imagery. The term does not imply that the centre is necessarily devoid of sensory function.

of the cortical matter of the frontal, parietal, and occipital regions is greater in the left hemisphere than in the right. This phenomenon is probably in the nature of effect rather than cause. Ogle has suggested that dextrality is occasioned by certain peculiarities in the mode of development and distribution of the left and right carotid arteries. A freer blood supply to the left hemisphere is invoked as the cause of this hemisphere's earlier development.¹ But if a freer blood supply to the left hemisphere were to account for its earlier development, it would not necessarily follow that the earlier development of the hemisphere explains its exclusive control of memory.

The confinement of the memory-centres to one hemisphere probably renders possible a greater richness of associations; thus the phenomenon might perhaps be explained by natural selection. In any case, the fact remains that the memory-centres are restricted to the left hemisphere in right-handed persons, and to the right hemisphere in left-handed persons.

The site of the memory-centres can be designated with considerable accuracy. This is especially true of the memory-centres concerned in speech, for the slightest injury to a speech-centre at once gives rise

¹ In many left-handed persons a freer blood supply has been found to obtain for the right hemisphere.

to characteristic symptoms. The *auditory verbal* memory is subserved by the posterior two-thirds of the first temporal convolution (A. V. in Figure 5). The anterior third of this convolution is generally regarded as the seat of the musical memory. The

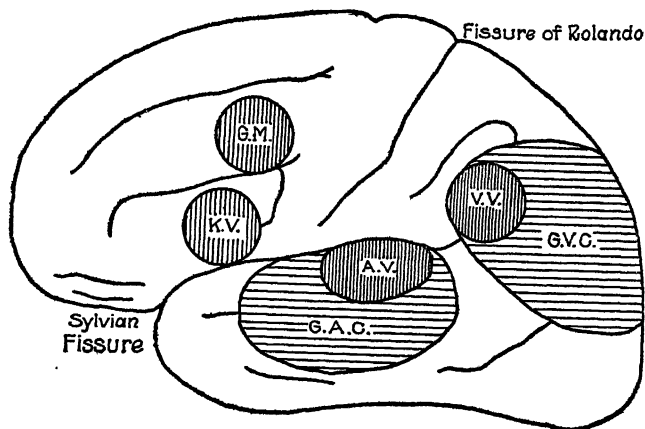


FIG. 5. —Diagram showing the approximate site of the principal memory-centres of the brain (after Bastian). G. M., graphic-motor centre; K. V., kinæsthetic verbal centre; G. A. C., general auditory centre; A. V., auditory verbal centre; G. V. C., general visual centre; V. V., visual verbal centre.

second temporal convolution is less important; it is subservient (probably with some assistance from the first temporal convolution) to the memory for ordinary physical sounds. The *kinæsthetic verbal* memory is located in the posterior part of the third frontal convolution (K. V. in Figure 5). The kinæsthetic

verbal centre is known as "Broca's convolution."¹ The *graphic-motor* centre, the centre in which are stored kinæsthetic images of writing-movements, is generally assigned to the posterior part of the second frontal convolution (*G. M.* in Figure 5). This localization is questioned by some investigators.² The *visual verbal* memory — the memory for printed and written words — is located in the angular gyrus (*V. V.* in Figure 5). The *general visual* centre — for the memory of concrete objects — occupies the adjacent regions of the occipital lobe.³

It will be noticed that the visual memory-centre is anomalous in that it does not coincide with the centre for the reception of visual impressions, — the primary visual centre. There appears to be no doubt, however, concerning the location of these two centres. A lesion in the cuneate lobule results in hemianopsia, —

¹ Broca was the first to point out the intimate connection of this convolution with the function of speech. Broca's convolution was at first regarded as a unitary speech-centre.

² The centre for writing-movements is undoubtedly identical with that for hand-movements. We know that kinæsthetic images of writing-movements and of hand-movements exist. The psychological data are beyond question. The exact site of the brain-centre is a matter of secondary importance; hence it would be useless to discuss the merits of this allocation.

³ It must not be supposed that the position of each brain-centre is strictly delimited. Along the borders there must necessarily be considerable interblending; hence the adjunctive regions belong equally to the two adjacent centres. A lesion in these regions would affect both centres slightly, and neither of them radically.

blindness in one half of the visual field; but if the lesion is limited, it does not necessarily affect the visual memory. On the other hand, an injury to the angular gyrus and its adjacent region obliterates the visual memory, yet leaves physical sight unimpaired. The patient then sees quite clearly, but is unable to recognize objects and unable to think in terms of sight. These facts seem to indicate that there are discrete centres for the reception and retention of visual impressions. — A like condition may obtain for the other senses. There is some slight evidence for it in the case of audition.

The kinæsthetic memory-centres are anterior to the fissure of Rolando. This fact indicates that the somæsthetic area is not confined to the region posterior to the fissure of Rolando or that the sensory and memory centres in this instance do not coincide.

Large portions of the cortex seem to be neither sensory nor motor. They are regarded as association areas. The cerebellum is not an organ of conscious intelligence. It is intimately connected with the maintenance of equilibrium, and its function seems to be in general a coördinating one.

From the foregoing discussion it is manifest that we have not only memories rather than memory, but also brains — or brain-centres — rather than a brain. We have an auditory brain, a visual brain,

a kinæsthetic brain, and so on. These different brains, or brain-centres, may have different degrees of activity, resulting in different degrees of vividness in the various kinds of mental imagery. Different brain-centres participate in different acts of perception and conception. In some mental processes, all the brain-centres may be active; in others, perhaps only one or two.

In the reception of a simple sensation, the activity of only one brain-centre is necessary.¹ There are no associations; the mental process is complete when the sensation has become enregistered in the brain-cells. With perception or conception the matter is different; the stimulus must travel from one centre to another. To take Charcot's classical illustration of the child and the bell (and to consider first the manner in which the various elements of the percept or concept are established):²—The child takes the bell into his hands and receives a set of tactual sensations, the sensory stimulus travelling along the afferent nerves to the somæsthetic area of the brain and impressing itself in the cortex. At the same time the child sees the bell: ether waves affect the retina of the eye, and the afferent current travels along the optic nerve and effects chemical changes in the cells of the optic lobe. As the child hears the

¹ The right hemisphere is neglected for the sake of simplicity.

² See Ballet, "Le langage intérieur et l'aphasie," 2d ed., pp. 6 ff.

bell, air-vibrations impinge upon the drum of the ear, and the stimulus is conducted along the auditory nerve to the auditory brain-centre, where the impression is enregistered. Kinæsthetic impressions are similarly enregistered in the cortex. Thus there are at least four brain-centres subserving the child's concept of the bell even before he has learned to talk.

And now for the act of perception. When the child sees the bell on some subsequent occasion, the appearance of the object arouses memory-images of its sound and of the feeling derived from handling it.¹ The excitation travels from the primary visual centre to the secondary, or memory, centre; whence it radiates to the auditory, tactile, and motor memory-centres. If one of these centres should be impaired, or if a set of association-fibres should be severed, the act of perception would remain incomplete. With the auditory perception the process is similar. Cells in the auditory centre are first excited; then the stimulus is diffused into the visual, tactile, and kinæsthetic centres; and the sound of the bell arouses mental images of its appearance, feeling, etc. If the child were to feel the bell in the first place, the tactual sensation would (by this process of irradiation) arouse mental images in the auditory and visual centres, and the perception would be complete.

¹ With a young child several repetitions of the experience would be necessary to establish the associations.

Obviously there are numerous different doors through which the percept can be aroused. The bell may be visually perceived as one catches sight of it; it may be tactually perceived as one grasps it in the dark; and it may be auditorily perceived as one hears it in another part of the house. In any one of these cases the bare sensation would be practically meaningless if the stimulus were not to travel beyond the "receptive" centre and arouse the associated mental images.

Taking, for further illustration, the percept of an orange, we have two new classes of sensations that may arouse associated images. The orange may be perceived if it is merely smelled. It may be perceived equally well by taste. The mental process becomes a perception, rather than a sensation, when the stimulus travels from the gustatory or olfactory centre to the memory-centres for visual and tactual impressions.

It is evident that the conceptual and perceptual processes are analogous. The nucleus of the percept is the sensation occasioned by the stimulus to the peripheric sense-organ: the activity of the cortical cells is instigated from without. The nucleus of the concept is a mental image — produced by the idio-activity of the memory-cells. An illusion — a false perception — is due to the fact that the excitation traverses inappropriate fibres and reaches an inappro-

prate cell. Illusions occur most frequently during expectancy, — that is, when particular memory-cells are unusually active or “excitable.” It seems as though an efferent current comes out to meet an afferent current and diverts it from its proper course. In hallucination (as distinguished from illusion) the memory-cell reaches plenary activity without external stimulation. The mental image is then mistaken for a sensation.

Concepts and percepts are further complicated by the introduction of language. In the cases cited above, the word *bell* or *orange* is introduced as an integral part of the concept. When the word is heard or thought, the various associated images arise in the foreground of consciousness or appear in the “fringe.” Conversely, if the bell or orange is seen, or is thought of in any form of mental imagery, its name is aroused by association.

Wyllie performed an interesting experiment to illustrate the mental processes in perception,¹ — using a number of children as subjects. He called one boy into the room and showed him an apple lying upon the table. The boy was asked to state what the object was. The answer came at once, “It is an apple.” The second child was permitted to smell the apple after his eyes had been bandaged. He likewise named the object immediately. The third boy had a piece of

¹ “Disorders of Speech,” pp. 227 ff.

an apple placed in his mouth. The fourth had an apple placed in his hands. Both of them named the object correctly. With other subjects the apple was placed close to the ear, so that the sound could be plainly heard. Many of them recognized the sound. The final experiment was an appeal to the kinæsthetic sense. An artificial apple, made of metal, was placed upon the table. The imitation could not be detected by the eye, but the deception was immediately recognized when the apple was taken into the hands.

In these different acts of perception the word-image *apple* may have been directly aroused by the sensation, or it may have been indirectly invoked through one of the awakened mental images. In any case the word is aroused by the overflow of the mental "current" into the adjoining brain-centres. The process is dependent upon the integrity of the brain-cells and fibres concerned. It is found in some pathological cases, where certain brain-fibres have been severed, that a person may recognize an object placed in one hand though he cannot recognize it when it is placed in the other. The break in the fibres furnishes a check to the mental current, so that it cannot pass into the adjoining brain-centres and awaken the associated mental images.¹

In the case of the congenitally blind or congenitally deaf, whole brain-centres are ruled out of the per-

¹ In such cases the interruption is probably in the transverse fibres.

ceptual and conceptual processes. The mental current can never enter these areas to awaken visual or auditory ideas. If the person is both blind and deaf, the mental current is restricted almost exclusively to the anterior portion of the brain. If the visual or auditory areas become damaged later in life, when the person is dependent upon his images of sight and hearing, mental efficiency is greatly impaired.

In the foregoing discussion the word-image has been treated as though it were a unitary image that could be aroused through the activity of a single brain-centre. Such may be the case in rare instances, — in the typical audile, for instance. But, as we have seen in the preceding chapter, the word-image is usually complex, and its appearance in consciousness often requires the activity of a number of different centres.

We may consider first the simple memory-image of the spoken word uncomplicated by visual images of written or printed words or by kinæsthetic images of writing-movements. In this case the word-image is subserved by the kinæsthetic verbal centre and the auditory verbal centre (*K. V.* and *A. V.* in Figure 5). With the *articulo-moteur* the activity may be limited in silent thought almost exclusively to the centre *K. V.* This person feels his words when thinking them. When the activity begins in *A. V.* (as he is

listening to the speech of another person) there is an overflow into *K. V.*, and he mentally articulates the words as he hears them. With some motor-minded persons the activity of *K. V.* appears to be indispensable for silent thought and the interpretation of spoken words. A lesion in the kinæsthetic verbal centre then impairs silent thought and renders the interpretation of spoken language extremely difficult.

With the average person the activity of both *K. V.* and *A. V.* is essential for silent thought. The more prominent articulative movements are mentally felt, and the whole word — or simply the vowel — is at the same time mentally heard. The activity commences in *K. V.* and flows into *A. V.* Frequently the mental process remains incomplete. One remembers the letter that begins a particular word without being able to recall the rest of it. (There are no visual images present: the initial articulative movement is simply felt.) It seems that the neural current is checked in its passage from *K. V.* to *A. V.*, or that the cells in *A. V.* are abnormally torpid.¹

When the auditory tendency predominates, the activity may perhaps begin in *A. V.* and overflow to some extent into *K. V.* This is an inverted order of association, and probably does not usually occur. When the image is initiated in the centre *A. V.*, it

¹ The idea of a neural current is more or less a working hypothesis. It is not known exactly what takes place in the brain during thought.

has, without the addition of the motor image, the "fulness" and "roundness" of a mental word. When the image is initiated in *K. V.*, it is often attenuated till *A. V.* has supplied the mental sound. Conjoint activity of the two centres is necessary in the latter case, but not in the former. When the activity begins in *A. V.*, the person is probably a pure audile.

With the educated person the kinæsthetic and auditory verbal centres are supplemented by two centres connected with the faculty of reading and writing. These are the visual verbal centre, presiding over images of printed and written words, and the graphic-motor centre, presiding over the kinæsthetic memories of writing-movements (represented respectively as *V. V.* and *G. M.* in Figure 5). The centre *V. V.*, in the angular gyrus, plays a prominent part in verbal representation with eye-minded people. The activity begins in *V. V.* and flows into *K. V.* and *A. V.* This happens when the person reads his words from an imaginary printed strip, or sees them before him in any form of visual imagery. The activity may in rare instances be confined to *V. V.*; in this case the visual image of the word does not arouse the image of the spoken word. This happens with the deaf-mute that has learned to read and write, but not to speak. The associations of meaning are attached directly to the visual image as a nucleus. With all

persons the activity commences in *V. V.* during the act of reading; it then passes into *K. V.* and *A. V.* as the printed word arouses the memory of its spoken correlate.

With the visile, the auditory impression of a word frequently awakens the associated visual verbal image. In this case the activity flows from *A. V.* into *V. V.*: the stimulus passes from cells in the first temporal convolution and along the associational fibres into the angular gyrus, where the related cells are excited. If the words are to be written from dictation, the stimulus passes on to the graphic-motor centre, and kinæsthetic images of the necessary hand-movements are provoked.

The graphic-motor centre, unlike the three other verbal centres, plays no prominent part in verbal thought. The reason for this is undoubtedly found in the complexity of the imagery that it subserves. The graphic-motor image would, by its duration, materially impede the thought-processes. The other verbal images can arise instantaneously, and for this reason are better adapted to verbal thought. The graphic-motor image does, however, frequently arise in the motile during moments of preoccupation. This is especially true of the subject that spends much of his time in writing. As he hears a word to which he is paying no particular attention, or thinks a word in a casual way, he may find himself mentally penning

the letters that compose it. This phenomenon is due to the passage of the stimulus into the centre *G. M.* The present writer, in whom motor images are signally strong, frequently experiences a curious obtrusion of the kinæsthetic images. As a word rises in the mind during a moment of abstraction, he frequently finds himself mentally tapping the word out on a typewriter. There is seldom present a visual image of the keyboard. When it appears, it is rudimentary to the last degree. There is no mental imagery of sound. The overflow is confined to the hand-movement centre. If it passes to the visual centre, the current is either too weak or the cells are too torpid to permit the arousal of a clear visual image. If the current passes to the auditory centre, it is again too weak, or it meets with insuperable inertia.¹

¹ In the case of the writer, the visual images are usually vestigial or schematic. Auditory images are practically non-existent.

CHAPTER V

THE RELATION BETWEEN MENTAL IMAGERY AND VOLUNTARY SPEECH

WHAT is the cause of a voluntary muscular movement? Exactly what is it in the mind that directs such a movement as lifting the arm, for instance? Why is the act invariably the appropriate one, and why does one not protrude the tongue or suddenly sit down instead of executing the arm-movement intended? The opinion that finds the widest acceptance among psychologists is that the immediate provocative of a voluntary movement is a mental image of the effect that the movement will produce. This effect may be the *feeling* of the movement itself, or the impression of certain results that the movement produces indirectly.

The memory of the direct effect James calls the *resident image*.¹ It is the tactile memory of the different cutaneous sensations, and the kinæsthetic memory of tendinous strain, contraction of the muscles, movement of the joints, etc. The indirect effect of the movement may be the sound of a bell, a note

¹ "Principles of Psychology," Vol. II, pp. 488 ff.

from a violin; it may be a tactile sensation as one plunges the hands into water, an olfactory sensation as one lifts a rose to the nostrils, or a gustatory sensation as one raises a cup of coffee to the lips. This resultant sensation James calls the "remote" effect. The memory of it is the *remote image*. Apparently, either the resident or the remote image may excite a muscular movement. It is probable, however, that when the remote image appears to be the sole instigator of the movement, the resident image is really sandwiched in between the remote image and the movement executed. It would be quickly swamped by the kinæsthetic sensations.

Kinæsthetic images have a remarkable propensity for self-expression. With many persons they give rise to incipient movements. Thus we see the person that moves the lips while reading or thinking intently, and the person that thinks aloud. These movements might be ascribed to the remote as well as to the resident image, but it is easy to show that the resident image is always straining at the leash and endeavoring to express itself in movement. Let the reader place an arm upon the table, and rigidly contract its muscles. Then let him endeavor to obtain in memory a clear feeling of the arm's relaxation. Any degree of success is immediately accompanied by a diminution in the tension of the muscles. Let the reader then place both arms upon the table, and

firmly contract the muscles of the right arm while relaxing the muscles of the left. Let him then attend to the feelings in the rigid arm and the relaxed arm alternately. As he attends to the contraction of the muscles in the right arm, the muscles of the left tend to contract likewise. As he transfers his attention to the left arm in order to effect its relaxation, the tension of the right arm diminishes. In this case the sensory impressions play the part that is usually taken by kinæsthetic images.

Muscle-reading (the "willing game") is based upon this propension of the kinæsthetic image for expressing itself in movement. The performance is usually represented as mind-reading. The performer undertakes to find, while blindfolded, a certain object that has been hidden in the room. He takes the hand of the "medium" (who of course knows where the object is hidden), and proceeds to "receive" the thought, the rest of the company meanwhile concentrating intently in order to render "telepathic" assistance. The medium is exhorted to "think hard," and so on. In a few minutes the hidden object is found. What happens is that the performer reads the little pulls and tugs of the "medium's" hand, which the latter is quite unconscious of making. As the "medium" endeavors to concentrate his thought, his kinæsthetic images become more intense or come more to the foreground of consciousness, and without his knowl-

edge they find expression in incipient movements. Frequently these movements are so conspicuous that the veriest novice could not fail to find the hidden object. He is, in fact, led to the hiding-place. Usually, of course, the movements are inchoate; but the experienced muscle-reader finds them sufficiently conspicuous for his purpose.

The resident kinæsthetic images are undoubtedly the sole mental cues for the grosser muscular movements. For the more delicate muscular movements — those involved in whistling, singing, speaking, etc. — the remote images coöperate. In the deaf or blind, or in those that are both deaf and blind, many of the remote images are lacking. The congenitally deaf learn to speak by feeling in the same way that the congenitally blind learn to write by feeling. The mental cues are in each case resident rather than remote.¹

¹ The question naturally arises as to how the first movements come to be performed in order that the resident images may be established. The answer is found in the biological principle (expressed as the *dynamogenic law*) that living matter tends to convert a sensory stimulus into a motor response. The child's earliest movements are purely involuntary: he is nothing more than a passive spectator of what is going on. The earliest random-spontaneous movements are generally bilateral; they are the kicking of the legs, and the waving of the arms. Later comes vocal play, — cooing, babbling, etc. (usually prompted by feelings of bodily comfort). The resultant images are enregistered in the mind, and the child is later able to perform, voluntarily, movements that were at first

The question now suggests itself as to whether or not one has any *direct* control of the emission of the motor current. The most natural conception of the matter is that the outgoing current is actually felt, and that its discharge is under the direct control of the will. It will be pretty generally conceded that the motor current must be sentient if its emission is to be voluntarily directed. But *is* the motor current sentient? The current exists beyond a doubt, but that its discharge is actually felt is denied by many competent psychologists. What is usually mistaken for the feeling of innervation is nothing more than the kinæsthetic sensations — the feelings from the muscles, tendons, articular surfaces, etc.

That these feelings are afferent rather than efferent, spontaneous. "It follows from this that voluntary movements must be secondary, not primary functions of our organism." (James, "Psychology," Vol. II, p. 487.) These earlier movements of the child are, of course, elementary. When he has gained control of his legs, arms, and fingers in the manner described, his further movements are in the nature of combinations of these elementary movements. The child's operations are henceforth voluntary, but for many years he progresses very largely by trial and error.

All of the bodily movements are not necessarily random-spontaneous in their inception. Many of the earliest movements are externally impressed upon the limbs.

It is obvious that but for memory the child would remain an organism responding to external stimuli. With memory, he is able to respond to *internal* stimuli; *i.e.* he is able to effect "voluntary" movements.

is evident from the fact that one has an exact appreciation of any movement that is externally impressed upon the limbs. There can be no feeling of innervation in this case; yet the sensations do not differ in quality from those accompanying a voluntary movement. Furthermore, accurate discriminations of weight can be made when the muscles of the arm are made to contract artificially by means of an electrical stimulus (Bastian). There is no motor current present, yet the amount of the muscular contraction can be accurately determined. It is clear that the feeling of effort and the supposed innervation-feeling must in this case be purely afferent.

It will be noticed that these feelings inhere in the muscles actually participating in the movement. Hence, if the feeling emanates from the *outgoing* current, it must be felt along the path of its discharge. This being the case, it should be possible to trace the course of the current through every nerve that it traverses. The experiment of contracting the muscles of the arm or leg will show that all consciousness of the movement comes exclusively from the limb affected. It is impossible to trace the motor channels through the spinal cord, for instance. Hence one must conclude that only the *ingoing* current is felt.

The argument might be advanced that, even if the motor current is not felt in the path of its discharge, its emission is distinctly felt and controlled

at its source. Introspection refutes the argument. There are many fugitive sensations that might be mistaken by the untrained psychologist for this feeling of the effort of the will. Such, for instance, are sensations from the contraction of the brow, the tension of the scalp muscles, the occlusion of the glottis, etc. But when these sensations are eliminated, nothing further remains. The only feelings discoverable are those in the muscles, tendons, etc. It is impossible even to tell in which hemisphere of the brain the motor cells reside.

There is another cogent argument against these innervation-feelings. There is no conscious innervation in reflex, automatic, and secondary-automatic acts. The acts simply perform themselves in response to the appropriate stimulus. In most cases the innervation is altogether beyond the control of the will. Yet the secondary-automatic acts were at first voluntarily performed. If sentient innervations exist, we must suppose them to have been present when the movement was still voluntary. But in some mysterious way they have relinquished their function, and *insentient* innervations have replaced them. The existence of such a condition of affairs seems improbable.

The import of the foregoing arguments is that the motor current is not sentient,—that it is not felt in the path of its discharge and that it is not felt at

its source. It is impossible to suppose that the innervation-current can be insentient, and yet be under the control of the will. Consciousness cannot control that of which it is unable to take cognizance. And if we suppose that the will is in any way able to emit the motor current, we must concede that the will is a physical force; whence we find ourselves in conflict with the law of Conservation of Energy. The attempt to compromise by supposing that the will does not discharge the current, but merely controls it, leads to the same dilemma: a force can be controlled only by a force.

It is evident, then, that there can be no direct control of the efferent current. Muscular movements are controlled *indirectly*, — by attention to the results they produce. The non-psychologist may find it difficult to subscribe to this thesis, but his acceptance or rejection of it need not affect his attitude toward later discussions. If he holds that the discharge is voluntary, he must admit that its purpose is foreseen. To admit that the purpose is foreseen is to admit that the nature of the act is determined by antecedent mental images. Thus the image remains paramount, whatever views be held on innervation. The hegemony of the mental image may, then, be regarded as established.

The subject of indirect control — through the mental image — need not be discussed at length.

Whatever views be held concerning the *fiat* — the decision to act — the admission must still be made that *the mental imagery alone determines the nature of the performance*. With this point granted, we can return to the subject of speech.

Our task is to ascertain the relative importance of the kinæsthetic and auditory imagery in the initiation of oral speech. It can be shown at the outset that the kinæsthetic centre can in some cases assume the sole directive function in oral speech, just as it can assume the sole direction of verbal thought. In the congenitally deaf that have acquired the mastery of language, speech must be evoked almost exclusively by kinæsthetic cues. Some assistance may be derived from visual images, but auditory images are out of the question. In the case of the deaf-blind Helen Keller, both visual and auditory images are excluded, and speech is initiated exclusively by images of feeling. Among persons not deprived of any of the senses, we find a few that have practically no auditory memory. It is evident that they must resort to motor cues for the instigation of oral speech. Occasionally one of these “articulo-moteurs” suffers an injury to the auditory verbal centre, and whatever auditory images existed are destroyed with the brain-cells. Yet verbal thought and speech remain unimpaired. The patient

is merely unable to interpret words that he hears. It is evident, then, that oral speech can in some cases be actuated exclusively by kinæsthetic images, the auditory images being dispensable.

Taking the opposite aspect of the question: Can the auditory images of themselves incite speech? Apparently they can not, though there are several facts that indicate the contrary if they are only superficially examined. It will be well to consider these facts carefully.

Children that are born deaf do not naturally learn to speak.¹ The usual inference is that the non-development of speech is due to the absence of auditory imagery. But speech can develop without auditory imagery, and often when hearing is present the sense is little more than a guide during actual enunciation. Hearing is important for the child while he is acquiring speech, even though he be an articulo-moteur; but in spite of this fact he may remember words in terms of feeling and not in terms of hearing. Thus the dumbness of a deaf child cannot be attributed to the lack of auditory images any more than to the lack of kinæsthetic images. His dumbness is due to the fact that he has not had hearing as a guide.

A child that loses his hearing at the age of five or

¹ "Puppies, or even dogs, are rendered dumb by the destruction of the internal ear." Waller, "Human Physiology," 3d ed., p. 550 (cites Danilewski).

six gradually becomes dumb unless he is drilled in articulation. The dumbness is frequently attributed to the gradual disappearance of the auditory images. The auditory images admittedly fade from consciousness, but their disappearance is not necessarily the cause of the muteness. Deafness is a mental cataclysm for the child; it entails a sweeping change in his psychic life. It would indeed be remarkable if the child should evince a disposition to talk when his own words have ceased to be audible to him. He may attempt to speak, but his world of hearing has been blotted out, and he does not even know whether he is uttering sound or not. He probably believes that his speech is affected as well as his hearing — if, indeed, he is able to analyze the situation at all. The fact that the child *does* retain possession of his speech if he is carefully drilled in articulation is conclusive evidence that acoustic images are dispensable for oral speech, for it is generally admitted that privation of hearing at an early age entails obliteration of the auditory imagery.

There is another argument that is sometimes adduced in favor of a purely auditory incitation of oral speech. Occasionally a child gives utterance to several consecutive words in his initial attempt at speech. In such cases the development of speech is usually delayed, and the child makes no use of language till suddenly moved by some intense emotional

excitement.¹ The argument is that, since the child has not previously spoken the words, he can have no kinæsthetic memory of them. From this it is inferred that the words are prompted solely by auditory cues. However, in such cases the child usually indulges freely in "baby-chatter" before he utters his initial sentence, and in this way he establishes an association between the feeling and the sound of the syllables he utters. Many of the elementary sounds are thus represented in both kinæsthetic and auditory memory. Children usually learn language in this piecemeal fashion, and they have undoubtedly both kinæsthetic and auditory images of the elements of speech they have mastered. Elements that are not clearly represented in motor memory are mispronounced; ultimately they are mastered by process of trial and error. New words are learned by recombining the different elements, and since these are represented in both kinæsthetic and auditory memory, it is not necessary that a word should be prompted at its first appearance by purely auditory imagery. The articulo-moteur may turn to the dictionary and read off hundreds of words that he has never before pronounced, yet the words are not initiated by auditory cues. He cannot even

¹ In a case cited by Bastian the child did not speak till he was five years of age. Then, upon breaking a toy, he suddenly exclaimed, "What a pity!"

think the words in auditory imagery; he finds that he must mentally articulate them. This fact conclusively demonstrates that, when once the elements of speech are mastered, any new combination of them may be represented in kinæsthetic imagery prior to its first enunciation.

Thus, the arguments in favor of a purely auditory incitation are easily refuted. Those opposed to it are conclusive.

If it were always possible for one to pronounce words of which he has a clear auditory image; then the child should blossom into a fluent speaker as soon as the neural speech-mechanism becomes functionally mature.¹ As soon as he speaks his first few words, he should be able to pronounce any word that he is able to think in auditory imagery. He should have no difficulty in repeating any word that is spoken to him, for the primary memory would be distinct, even if no secondary memory were to endure. The child should have no difficulty with his *G*'s, *K*'s, *L*'s, and *T*'s: He should be able to trill his *R*'s, and pronounce German gutturals and French nasals the moment he hears them. We know, of course, that

¹ "For it may fairly be said that the great majority of children can remember the names given to many external objects when they are four or five months old; their memory in this respect continually increasing through succeeding months, even whilst they still make no very distinct efforts at articulating words for themselves." Bastian, "The Brain as an Organ of Mind," p. 604.

this is not the case, but that the child usually takes years to master the elements of even his own language. He proceeds by trial and error, and has no thorough command of language till the kinæsthetic images of speech are established.

Exactly the same argument applies in the case of the adult to the mastering of foreign languages. If speech-initiation could be accomplished by pure auditory imagery, one should be able, as soon as the auditory memory is established, to utter any sound producible by the speech-organs. The primary memory would be sufficient; and one should be able to repeat upon the demand the most difficult combinations in Chinese, German, Swedish, or any other language. The Englishman should be able to repeat the uvular *R* the first time he hears it; the German should have no difficulty whatever with the English *Th*. However, this is not the case. Few adults can master even one foreign language and speak it with a pure accent. As Kussmaul says:¹

“No living person is able to pronounce the speech-sounds of all the different races of the world. A Lepsius may express them in writing, a Brücke may discover the processes involved in their articulation; but even such scholars cannot articulate them all. In the speech of every race only certain sounds are developed, while other sounds are entirely neglected. Thus there occurs a national and dialectical *mogilalia*.”

¹ “Störungen der Sprache,” 4th ed., p. 257.

Yet such difficulty with foreign languages would never arise if auditory imagery were in itself sufficient to incite oral speech. It is evident, then, that there can be no *pure* auditory incitation of speech, but that kinæsthetic images are also requisite. The audile, then, becomes an *audito-moteur* when oral expression is concerned.

The auditory image, nevertheless, plays a conspicuous rôle in the evocation of oral language. Any impairment of the auditory brain-centre usually induces a marked disturbance in speech. But the auditory image never assumes exclusive control of oral expression. This is proved by the fact that a person invariably becomes mute if the motor memory-centre⁴ is destroyed.

The auditory image is important in musical expression. There is with some persons an *absolute musical memory*, — a musical memory that permits them to produce a note of any desired pitch. It is manifest that in such cases the auditory image must be almost exclusively responsible for the note produced, for the note must be remembered as sound, and not as feeling. Again, in singing and whistling, the auditory image determines almost exclusively the nature of the production. But even in singing, the kinæsthetic image plays an important rôle. The powerful articulations of a concert singer — or of one that sings so that his audience can understand him

— are produced more by images of muscular movement than by images of sound.

Auditory imagery is an important factor — though, again, never the sole factor — in mimetic performances. Frequently the ear-minded person can give faithful imitations of a brogue or a dialect, or he may be able to imitate the timbre of another person's voice. He is able to succeed because he mentally hears the sounds he is about to utter. The articulo-moteur flounders helplessly with the same task. He must experiment with various conformations of the speech-organs; and if he finds one that gives the desired result, he must remember it by feeling. Naturally enough, he meets with little success as a mimic. But even the *audito-moteur* depends upon his kinæsthetic imagery to a great extent. He may not succeed in imitating a voice at the first attempt, but he succeeds after a little practice. The practice, however, does not enhance the vividness of the acoustic imagery; it merely establishes an association between the auditory images and the images of related articulative movements. Mastering the pronunciation of foreign languages is largely a matter of imitation; thus the *audito-moteur* meets with greater success than the *articulo-moteur* in this particular field.¹

¹ This fact does not refute the former argument concerning the acquirement of foreign languages. The audile masters a foreign language more readily because his auditory imagery assists him, —

The import of the foregoing arguments is that the average person, the audito-moteur, employs both his *resident* and *remote* verbal images to incite oral speech; *i.e.* that he relies upon both his kinæsthetic and auditory images of words. The kinæsthetic image is a memory-image of the movements of the jaw and lips and of the grosser movements of the tongue; and it is these movements that are prompted by the motor memory. The more delicate speech-movements — those producing fine differences in vowel-coloration — undoubtedly occur, in all but the articulo-moteur, in response to the auditory image of the sound desired. The resident, or kinæsthetic, image is in the latter case probably intercalated between the thought of the sound and its utterance; but it is the remote sound-image, the image of the vowel-color, that initiates the process.

With regard to the cerebral mechanism it is certain that the kinæsthetic memory-centre acts directly upon the executive motor centres. The only question involved is whether the auditory centre is able to act directly upon the executive motor centres or only through the medium of the kinæsthetic centre. Pathological cases indicate that the latter is the existing condition, but the matter cannot be said to be

not because the auditory imagery takes entire charge of the enunciation. Without motor imagery, speech of any kind would be impossible.

definitely settled. In the case of the articulo-moteur the motor mechanism is actuated exclusively from the kinæsthetic memory-centre. A similar condition may prevail with the audito-moteur; but if such is the case, the kinæsthetic images of the more subtle lingual and laryngeal movements are aroused by the auditory images through association. One fact is established beyond all possibility of doubt, — that with the audito-moteur the integrity of both the kinæsthetic verbal centre and the auditory verbal centre is essential for oral speech. To express the matter in terms of consciousness: there must be present in the mind a mental image of the feeling of a word, and a mental image of its sound.

If the feeling-image were a perfect representation of the movements of speech, no sound-image would be necessary. The sound-image supplements the feeling-image where the latter is deficient; in other words, its chief function is to supply the more delicate movements that produce the vowel.

A word may be said at this point concerning the speech of the orally taught deaf. The speech-cues of the deaf are both kinæsthetic and articulatory-visual; the visual images, like the auditory images with the normal person, being remote. Visual images cannot incite speech directly, but it is probable that with some deaf persons the primary revival of thought

takes place in the visual centre, and that the visual articulative images then arouse the images of feeling. The process is analogous to the visile's seeing images of printed words before he mentally hears and feels them. The deaf person employs sight as a substitute for hearing, and he interprets the spoken words of another person by visually reading the lips, tongue, and facial muscles. This visual appreciation of speech may be complete *before* the pupil has gained thorough mastery of his own speech-organs;¹ hence it follows that visual images are not in themselves sufficient for the evocation of spoken language. The words must be felt as well as seen. The delicate movements of the larynx and pharynx, as well as many movements of the tongue, are hidden from view; and they must be detected by feeling. It is this fact that so greatly retards the pupil in the acquisition of oral speech. Again, the difference between the surd and sonant consonants must be felt rather than seen. One cannot detect by sight the difference between *B* and *P*, and *D* and *T*, for instance. When the deaf person articulates these letters and such words as *gain* and *cane*, and *view* and *few*, he *feels* the difference between the surd and sonant consonants. The only difference

¹ "In many oral classes a few of the scholars who are deficient in their speech are able to follow their teacher's lips throughout the course and keep as well to the fore as the others." Farrar, "Arnold on the Education of the Deaf," p. 219.

is in the point at which vocalization begins; and this difference makes no appeal to sight.

When the deaf pupil has mastered the art of speech, he frequently interprets the words of other people in terms of feeling:

"The deaf person, as he reads the face of another, mentally converts what he sees into the organic action by which the sound or sounds are produced; so much so that he often repeats to himself what he sees the other saying."¹

These facts show that the kinæsthetic images are in the deaf at least as conspicuous as those of sight. In speech, the visual image is undoubtedly remote; its function is that of arousing the kinæsthetic image by association rather than that of acting directly upon the executive motor centres.

¹ "Arnold on the Education of the Deaf," p. 217.

CHAPTER VI

IMPAIRMENT OF THE BRAIN-CENTRES: APHASIA

A PERSON suffering a lesion in one of the memory-centres incurs obliteration or impairment of the corresponding mental imagery. A lesion in the left occipital lobe destroys the images of sight. Damage to the angular gyrus effaces the visual images of printed or written words. An injury to the first temporal convolution destroys the auditory memory of words; while an injury to the posterior portion of the third frontal convolution destroys the kinæsthetic verbal memory.

The lesion must, of course, occur in the memory-hemisphere of the brain; that is, in the left hemisphere in right-handed persons, and the right hemisphere in left-handed persons. When it occurs in the other hemisphere, the intellectual life remains practically unaffected. When there is degeneration of the cortex rather than absolute destruction of the cells, the patient is still able to interpret sensations, though he is unable voluntarily to reintegrate the mental images. The inability to arouse mental images is called *amnesia*. The inability to interpret

sensations is called *mind-blindness*, *mind-deafness*, etc., according to the nature of the malady. This psychic blindness or deafness usually involves its corresponding form of amnesia, but the amnesia does not necessarily involve the inability to interpret sensations.

Aphasia is a generic term applied to these different forms of cerebral defects. It is applied more particularly to the cerebral disturbances of speech.

The significance of the loss of a particular type of mental imagery is determined entirely by the prominence of the imagery in thought. Deprivation of the visual imagery would be a calamity for an eye-minded person. Loss of the auditory imagery would be disastrous to an ear-minded person. But it is safe to say that few people would be inconvenienced by dispossession of their images of taste and smell, for these images have little significance for the intellectual life. General intelligence would suffer little from the loss of the musical memory; but such a loss would be calamitous for a composer or a musician. With many persons there is congenital olfactory, gustatory, or musical amnesia; more rarely there is congenital auditory or visual amnesia. In such cases an injury to the torpid brain-centre would have no effect upon memory. If the injury were profound, it would interfere with perception, but the concepts would remain virtually unaffected.

VISUAL AMNESIA AND OBJECT-BLINDNESS

A lesion in the visual memory-centre (*G. V. C.*, Figure 5) effaces the memory for visual experiences. If the degeneration of the cells is slight, the resultant disturbance may be merely visual amnesia, — inability to arouse the visual images. When destruction of the cells is complete, there is object-blindness in addition, and the patient no longer recognizes things that he sees. So long as the primary visual centres are unimpaired, the patient sees as well as ever. But he does not interpret his visual sensations; the world, as he meets it through sight, is as strange and incomprehensible to him as to a new-born child. He does not recognize a chair as a chair, nor a book as a book. He does not recognize his surroundings; and if the attack occurs suddenly, he may wander in the streets imagining that he is lost. He may refuse to enter his own home, declaring that the house is unfamiliar. He repudiates his friends, and in general conveys the impression that he is demented. Indeed, if he has no knowledge of the normal workings of his mind, he may himself imagine that he has become insane. A visile that becomes subject to such a malady has the most effective part of his mind blotted out. His intelligence is reduced in proportion as visual imagery formerly predominated in his thinking.

One of Bernheim's¹ patients was shown a brush, but he failed to recognize or name it.

"Of what use is it?" he was asked.

"It is used for walking," he replied; and when asked for a demonstration he proceeded to make the brush take steps. Later he exclaimed, "No, it is used for making strokes. No!" ("Non, c'est pour faire des barres. Non!") Then after a few minutes he finally recognized it: "It is used to brush with; it is a brush."

James² gives the following account of one of Charcot's patients that was suffering from visual amnesia and a marked degree of object-blindness:

"The patient was Mr. X., a merchant, born in Vienna, highly educated, master of German, Spanish, French, Greek, and Latin. Up to the beginning of the malady which took him to Professor Charcot, he read Homer at sight. He could, starting from any verse out of the first book of the Iliad, repeat the following verses without hesitating, by heart. Virgil and Horace were familiar. He also knew enough of modern Greek for business purposes. Up to within a year (from the time Charcot saw him) he enjoyed an exceptional visual memory. He no sooner thought of persons or things, but features, forms, and colors arose with the same clearness, sharpness, and accuracy as if the objects stood before him. When he tried to recall a fact or a figure in his voluminous polyglot correspond-

¹ *Rev. de méd.*, 1885. Quoted by Bastian, "Aphasia and Other Speech Defects," p. 212.

² "Principles of Psychology," Vol. II, pp. 58, ff. The original account appears in *Progrès Médical*, 21 juillet, 1883.

ence, the letters themselves appeared before him with their entire content, irregularities, erasures, and all. At school he recited from a mentally seen page which he read off line by line and letter by letter. In making computations, he ran his mental eye down imaginary columns of figures, and performed in this way the most varied operations of arithmetic. He could never think of a passage in a play without the entire scene, stage, actors, audience, appearing to him. He had been a great traveller. Being a good draughtsman, he used to sketch views which pleased him; and his memory always brought back the entire landscape exactly. If he thought of a conversation, a saying, an engagement, the place, the people, the entire scene rose before his mind.

"His auditory memory was always deficient, or at least secondary. He had no taste for music.

"A year and a half previous to examination, after business anxieties, loss of sleep, appetite, etc., he noticed suddenly one day an extraordinary change in himself. After complete confusion, there came a violent contrast between his old and his new state. Everything about him seemed so new and foreign that at first he thought he must be going mad. He was nervous and irritable. Although he saw all things distinct, he had entirely lost his memory for forms and colors. On ascertaining this, he became reassured as to his sanity. He soon discovered that he could carry on his affairs by using his memory in an altogether new way. He can now describe clearly the difference between his two conditions.

"Every time he returns to A., from which place business often calls him, he seems to himself as if entering a strange city. He views the monuments, houses, and streets with the same surprise as if he saw them for the first time. Gradually, however, his memory returns, and he finds himself at home again. When asked to describe the principal public place of

the town, he answered, 'I know that it is there, but it is impossible to imagine it, and I can tell you nothing about it.' He has often drawn the port of A. To-day he vainly tries to trace its principal outlines. Asked to draw a minaret, he reflects, says it is a square tower, and draws, rudely, four lines, one for ground, one for top, and two for sides. Asked to draw an arcade, he says, 'I remember that it contains semicircular arches, and that two of them meeting at an angle make a vault, but how it looks I am absolutely unable to imagine.' The profile of a man which he drew by request was as if drawn by a little child; and yet he confessed that he had been helped to draw it by looking at the bystanders. Similarly he drew a shapeless scribble for a tree.

"He can no more remember his wife's and children's faces than he can remember the port of A. Even after being with them for some time they seem unusual to him. He forgets his own face, and once spoke to his image in a mirror, taking it for a stranger. He complains of his loss of feeling for colors. 'My wife has black hair, this I know; but I can no more recall its color than I can her person and features.' This visual amnesia extends to dating objects from his childhood's years — paternal mansion, etc., forgotten.

"No other disturbances but this loss of visual images. Now when he seeks something in his correspondence, he must rummage among the letters like other men, until he meets the passage. He can recall only the first few verses of the Iliad, and must grope to read Homer, Virgil, and Horace. Figures which he adds he must now whisper to himself. He realizes clearly that he must help his memory out with auditory images, which he does with effort. The words and expressions which he recalls seem now to echo in his ear, an altogether novel sensation for him. If he wishes to learn by heart anything, a series of phrases for example, he must read them several times

aloud, so as to impress his ear. When later he repeats the thing in question, the sensation of inward hearing which precedes articulation rises up in his mind. This feeling was formerly unknown to him. He speaks French fluently, but affirms that he can no longer think in French; but must get his French words by translating them from Spanish or German, the languages of his childhood. He dreams no more in visual terms, but only in words, usually Spanish words. A certain degree of verbal blindness affects him — he is troubled by the Greek alphabet, etc.”

With an ear-minded person a corresponding cerebral lesion would have resulted less seriously. The visual images would, of course, have been obliterated; but their loss would not have been so grave a matter for a person living in a world of sounds. Conversely, the loss of the auditory images would have been a matter of little moment for the patient in question, for so long as the verbal imagery were not affected, the intellectual faculties would have been little impaired.

Defects of the visual memory are often associated with *homonymous hemianopsia*, — obliteration of one half of the visual field. This is due to the invasion, by the degenerative process, of the primary visual area in the cuneate lobule and its immediate neighborhood. The condition is one of physical blindness. It is anomalous only in the fact that it affects but one-half of the field of vision. If lesions occur in both cuneate lobules, the condition differs in no way from

ordinary physical blindness. When the lesion is limited to the primary visual area, there is no impairment of the visual memory-images.

VISUAL VERBAL AMNESIA, WORD-BLINDNESS, AND AGRAPHIA

A lesion in the angular gyrus (V. V. in Figure 5) annihilates the visual images of printed and written words. A superficial injury may entail merely the inability to reintegrate the visual images spontaneously. In this case there is visual verbal amnesia with agraphia — the inability to write. The patient cannot write because he is unable to *recall* the appearance of the word he wishes to pen. When the injury is profound, the patient is unable to *recognize* words that he sees, and the resulting condition is one of word-blindness¹ in addition to the visual verbal amnesia and agraphia. The patient occasionally retains his memory for letters and figures. This is accounted for by the fact that letters and figures are learned first and are consequently more deeply seated. In many instances the explanation is probably the existence of number-forms subserved by the general visual centre rather than the visual verbal centre.

The word-blind patient understands all that is said to him, and thinks clearly in words so long as the auditory centre is not affected. His difficulty is

¹ Word-blindness is sometimes called *alexia*.

merely in interpreting printed or written words. He sees the words in front of him, but they convey no more meaning than they would if they were upside-down, or were written in a foreign language.

The agraphia is not always complete. The patient often retains the ability to write his own signature, and perhaps a few short words or letters. These are probably revived in kinæsthetic imagery, — the patient writing by feeling. He can copy writing that is put before him, but he does not do so understandingly. He copies print in print, and script in script, writing like a forger that copies an inverted signature. Occasionally the word-blind person manages to divine the meaning of a written word by tracing it with his finger. In this case, when the angular gyrus is damaged, he interprets the word entirely by feeling. In attempting to write, the patient may produce a jumble of letters, likewise by feeling. This perversion of the faculty of writing is called *paragraphia*.

The following is a typical case of word-blindness, visual verbal amnesia, and agraphia, resulting from damage to the angular gyrus : ¹

“A female, aged 63, admitted into the Asylum of Villejuif on the 29th of Sept., 1891. Was intelligent, but had lost the power of reading and writing. Being anxious to regain the

¹ Wyllie, “Disorders of Speech,” pp. 349 f. Case reported by Sérieux, *Comptes rendus des séances de la Société de Biologie*, janvier, 1892.

power of reading and writing, she practised much with her pen; but her efforts resulted only in such confused collections of letters as the following — these being, moreover, written badly — in a tremulous hand — ‘*an um aa monon mono muosi!*’ The intelligence was normal, and there were no paralytic symptoms whatever. Vision was intact, and it is expressly stated that there was no hemianopsia. It was as impossible for the patient to read as to write. She could, however, recognize a few of the individual letters; and when a word was composed of these she could sometimes spell it out and pronounce it.”

At the autopsy there was found a softening in the angular gyrus and supra-marginal convolution, *i.e.* in the visual verbal area.

Word-blindness, strangely enough, does not always entail visual verbal amnesia. If the word-blindness were invariably due to destruction of the angular gyrus, amnesia would be an inevitable concomitant. However, it is sometimes induced by a subcortical lesion severing the visual memory-centre from the primary visual area. The consequence is that the visual sensation is unable to arouse the visual memory-image; thus no perception can take place. But so long as the cortical cells in the angular gyrus are unaffected, the visual images of words remain unimpaired. The patient writes spontaneously or from dictation with the greatest ease, exciting the graphic-motor centre from the visual verbal centre. But he cannot read the words that he has written, for the excitation in the primary visual area is unable to

reach the visual memory-centre. Occasionally the patient can interpret writing by tracing the words with a pen or with his finger. In this case the visual memory-images are aroused by the kinæsthetic impressions.

The following is a fairly typical case of subcortical word-blindness :¹

"The patient was a man aged 68. After a number of attacks of tingling in the right leg and arm, he suddenly perceived that he could not read a single word; but he still retained the power of writing, and indeed could write with perfect ease. For four years he remained in this condition — totally word- and even letter-blind, but able to write correctly whole pages of manuscript though quite unable to read them after they were written. He had also lost the power of reading musical notes, though he could still sing well. He retained the power of reading figures, and could do mental calculations as well as formerly. He had right homonymous hemianopsia.

"Ten days before his death, he became suddenly affected with very pronounced paraphasia, and with *total agraphia*; without, however, any paralysis of motion or loss of consciousness. There was no trace of word-deafness; and he retained his intelligence to the end."

At the autopsy there was found an old lesion that destroyed the primary visual area in the left hemisphere (this accounting for the right homonymous hemianopsia) and the commissural fibres uniting the

¹Wyllie, "Disorders of speech," pp. 339 f. Case reported by Déjerine, *Comptes rendus des séances de la Société de Biologie*, mars, 1892.

angular gyrus with the primary visual area of the right hemisphere. Thus the patient was blind in one-half of the field of vision; while impressions from the other half were unable to reach the memory-centre. These facts explain the word-blindness. The integrity of the angular gyrus explains the absence of agraphia. A recent lesion in the angular and supra-marginal convolutions accounted for the disturbances that occurred just previous to death.

A similar case is recorded by Ballet,¹ but he interprets his case somewhat differently. He supposes the patient to have suffered an injury to the angular gyrus, thus incurring obliteration of the visual images of words. In the absence of autopsical examination it is, of course, impossible to determine exactly what happened. There was right homonymous hemianopsia, so it is probable that the injury was similar to that in the preceding case. The patient was able to write. Ballet supposes that he relied upon his graphic-motor images. Such a condition would be possible in the motile, especially if he mentally spelled each word and wrote the letters as he mentally pronounced them. It is scarcely conceivable that even the motile should write long words by feeling, without assistance from other forms of verbal imagery. Ballet's explanation is not an impossible, though it seems an improbable, one.

¹ "Le langage intérieur et l'aphasie," 2d ed., pp. 104 ff.

There seem to be no cases of pure agraphia on record. Agraphia does occur without word-blindness, but it is usually complicated by paresis or cutaneous anæsthesia, and the patient is physically unable to write. The presence of paresis is accounted for by the proximity of the executive motor centres to the kinæsthetic memory-centres. In many cases agraphia is accompanied by motor or auditory aphasia, and the inability to write may be due to the obliteration of internal language.

Ballet¹ records a curious case of kinæsthetic amnesia that came under the observation of Charcot. The patient had lost his ability to play the trombone. He "had lost the memory of the associated movements of the mouth and hand required for playing the instrument. All the other motor memories were intact. This musician had forgotten the manipulation of the trombone, just as others forget the manipulation of the pen."

APHEMIA

We come now to the consideration of cerebral disturbances that more directly affect the faculty of oral speech. *Aphemia*, being the simplest disorder, will be considered first. Aphemia is a disturbance of speech due to lesion of the purely executive motor mechanism. The seat of the lesion may be the cortical motor centre at the foot of the precentral

¹ *Loc. cit.*, p. 134.

convolution, or the bulbar motor centres, or some point in the efferent tracts. The aphemia usually manifests itself in complete mutism. There is, however, no disturbance of internal language, — either visual, auditory, or kinæsthetic. There is no word-deafness or word-blindness.

The absence of word-deafness is easily demonstrated by the readiness with which the patient obeys orally imparted instructions. If he is told to take out his watch and wind it, or to take a book and open it at a certain page, he immediately obeys. Absence of word-blindness is shown by the patient's ability to comply with written instructions. Absence of amnesia is not so readily determined, for the patient may respond to external impressions and yet be unable to arouse the mental images spontaneously. Disturbances in the motor centre are very frequently accompanied by hemiplegia, — unilateral paralysis. This is due to the fact that the lesion is seldom limited to the mechanism concerned with speech, but invades other regions as well. When hemiplegia is present, the patient has great difficulty in expressing himself in writing. However, by using the left hand he can express, in a somewhat labored way, thoughts that occur to him spontaneously. This ability shows that he is able to think in verbal imagery. His ability to perform arithmetical problems, etc., also shows that internal language is unimpaired. The Proust-

Lichtheim test is often applied to ascertain the condition of the patient's internal language. If the patient's verbal thought is unaffected, he is able to indicate the number of syllables in a word, — the name of an object shown to him, for instance. This he does by making expiratory efforts, by pressing his interlocutor's hand, by tapping on the table, etc. In like manner he indicates the number of letters in a word; thus demonstrating his ability to spell the word mentally.

The ability of the patient to indicate the number of syllables in a word is regarded by some pathologists as evidence of the retention of the kinæsthetic verbal images. The ability to comply with the test is proof of the existence of some form of verbal imagery, but it does not seem to follow that the imagery must necessarily contain the kinæsthetic element. If the audile were able to make the words resound in his mind syllable by syllable, he could certainly comply with the conditions of the test. In the audile it would be scarcely possible to differentiate pure aphemia from loss of the kinæsthetic memory of words.

Doctor Samuel Johnson thus describes, in a letter to Mrs. Thrale, a temporary attack of aphemia that befell him in his seventy-fourth year:

"On Monday, the 16th, I sat for my picture, and walked a considerable way with little inconvenience. In the afternoon and evening, I felt myself light and easy, and began to plan

schemes of life. Thus I went to bed, and in a short time waked and sat up, as has long been my custom, when I felt a confusion and indistinctness in my head, which lasted I suppose about half a minute. I was alarmed and prayed God that, however He might afflict my body, He would spare my understanding. This prayer, that I might try the integrity of my faculties, I made in Latin verse. The lines were not very good, but I knew them not to be very good; I made them easily and concluded myself to be unimpaired in my faculties.”¹

This attack of aphemia proved to be temporary.

The following is a case reported by Déjerine.² The patient, an accountant, had become speechless after an apoplectic attack.

“He understands readily all questions addressed to him, either orally or by writing. He recognizes all external objects. Cannot utter aloud a single word either spontaneously, by reading, repeating, or singing. But he can indicate the number of syllables in the words he wishes to utter, by so many expiratory efforts or pressures with the fingers. By bringing one’s ear quite close to his mouth one can distinguish certain words pronounced in an excessively low voice — less than a whisper. Some of these words are not pronounced correctly, the articulation of the labials being especially interfered with — the *b* being pronounced like an *m*. And the same mistakes occur when he attempts to read or repeat a phrase as when attempting to utter them spontaneously. . . . The right hemiplegia being slight, the patient can make use of a pen, and writes either spontaneously, from dictation, or in copying. This he does fairly legibly and with no mistakes.”

¹ Quoted by Bastian, “Aphasia and Other Speech Defects,” p. 66.

² Quoted by Bastian, *loc. cit.*, p. 70.

At the necropsy there were found three small foci of softening: one beneath the lower extremity of the fissure of Rolando, one beneath the posterior extremity of the third frontal convolution, and one beneath the foot of the precentral convolution. Either of these last two lesions might have caused the aphemia. The one beneath the kinæsthetic memory-centre would have isolated the image-centres from the motor region. The one at the foot of the precentral convolution would have interfered with the emission of the motor current.

ARTICULATORY-KINÆSTHETIC APHASIA

Articulatory-kinæsthetic aphasia, or *motor aphasia*, is due to the total or partial obliteration of the kinæsthetic images of articulatory movements. It is caused by lesion of the posterior part of the third frontal convolution of the left hemisphere (*K. V.* in Figure 5). Motor aphasia is usually associated with right hemiplegia, this being due to the extension of the lesion into the true motor area of the brain. Strictly delimited lesions do not induce hemiplegia. The onset of the malady is usually abrupt; and if the lesion is extensive, the patient is speechless from the beginning. If the patient is an audile, there is no verbal amnesia so long as the auditory area is unaffected. The patient has clear acoustic images of words, but is unable to translate them into kinæs-

thetic images in order that he may express them. He is in the position of a man that can recall orchestral music, but has no means of externalizing his acoustic thoughts. If the patient is an articulo-moteur, internal language is annihilated. Since the average person is an audito-moteur, there is usually considerable amnesia. Patients with motor aphasia interpret spoken language with varying degrees of facility. At the beginning of the attack there is frequently considerable word-deafness owing to the inability of the acoustic impressions to arouse their kinæsthetic associates.

The following is a case of aphasia due to the partial destruction of the kinæsthetic memory-centre. The case is reported by Collins.¹

"Mrs. X—, a widow, sixty-three years old, the mother of eight children, has had a vigorous, active life, free from ill health, save that twelve years ago she suffered severely from attacks of renal calculi. During the past year or two she has complained of indigestion and more recently of a dull, aching sensation in the back of the head and neck, with occasional attacks of very severe pain in the left temple. For a few weeks previous to the beginning of her present symptoms she suffered from insomnia, from irritability, nervousness, and forgetfulness. Her son, a physician, gives the following account of the onset of her aphasic symptoms. One week before consulting me she discovered, while making a call, that her speech had become, without warning, very much embarrassed. She could not finish the sentence she had started to speak. She forgot

¹ "The Faculty of Speech," pp. 422 ff.

what she wanted to say. She chafed under this impotence and got very much excited. She returned home in a street car, and was much astonished to discover on looking at the signs with which the cars are lined that she was quite unable to comprehend their signification. She could see the letters and words, she knew that they were letters and words, but they conveyed no meaning to her. When she got home she tried to tell her family about her disability, but was able to say only a few words, and these were entirely disconnected. After trying to speak for a time she became excited and began to cry. On the following day when she awakened, she could say only 'Yes' and 'No,' but as the day wore on her vocabulary became somewhat larger. It was particularly remarked that when she was excited or very emotional sometimes words would flow out of her mouth in an astonishing manner. From that time until I saw her there had not been very much change in her capacity for speech production.

"The following is a stenographic report of the examination to determine the disorder of voluntary speech. In response to the question to tell me all that she could concerning the onset and course of her symptoms, she said :

"Well, mem-mem — three weeks, m-m-em — feel-m-em-em — sometimes [prolonged pause, seems to be thinking] couldn't thought — no thought — forget — but — eh — last Friday [another prolonged pause] am — no — noticed they — I couldn't — eh — I [prolonged pause] I couldn't tell, am, I don't, I can't, can't express [explosively] I can't tell — I cannot [points to her head and looks weary]. It seems, I can't, last Monday, con-con-nects — sentence, two or three words — gone. Was — gone, blank, didn't know. Can't think, was gone, forget — forget everything. Couldn't, couldn't, can't."

"To test her capacity to repeat, I asked her to say after me: 'I stood on the bridge at midnight.' Her reply was :

"‘I stood — the — night,’ said with great effort, and with apparent endeavor to repeat each word as quickly as they fell from my lips.

"‘Still sits the schoolhouse by the road?’

"‘Forget — yes — the — the — s’s’s’ forget — road.’”

The patient’s internal language was probably as defective as her speech. She indicated her inability to repeat inwardly the Lord’s Prayer, and she was unable to write either spontaneously or from dictation. She understood fairly well what was said to her; hence the auditory centre could not have been destroyed. Destruction of the kinæsthetic centre was incomplete; otherwise the patient would have been mute.

Destruction of Broca’s convolution does not necessarily entail obliteration of internal language. If the patient happens to be an audile, there may be no *amnesia verbalis* whatever. In fact, the case does not then differ in its symptoms from one of pure aphemia. In the following case of articulatory-kinæsthetic aphasia (recorded by Guido Banti) the patient was manifestly an audile, and he thought in auditory verbal images after the kinæsthetic images had been expunged:¹

¹ Bastian, “Aphasia and Other Speech Defects,” p. 89. Case reported by Guido Banti in “*Afasia e sue Forme, Lo Sperimentale*,” 1886, LVII, obs. II, p. 270, and quoted by Prévost in the *Revue médicale de la Suisse Romande*, June 30, 1895.

"A right-handed man, aged 36, who was able to read and write correctly, had a sudden apoplectic attack in 1877. Recovering consciousness in a few minutes he was found to be suffering from right hemiplegia and loss of speech. The paralysis of the limbs disappeared almost completely during the following night, though the inability to speak persisted.

"The next day he was admitted into hospital, and on most careful examination his condition was found by Guido Banti to be as follows:

"The motility of the limbs on the right side had returned to their normal condition. There was no trace of paralysis of the face or of the tongue. The patient made ineffectual attempts to speak; *he could not articulate a single word*, not even isolated syllables. He was much affected by this mutism, and sought to make himself understood by gestures. I asked him if he knew how to write, and after he had made a gesture in the affirmative I gave him what was necessary and told him to write his name, which he did immediately. I put various other questions to him, to which he replied similarly by writing. I told him to give me a description of his illness, and *he wrote without hesitation* the details above reported. I showed him various objects, pieces of money, etc., telling him to write their names, and he did so without making any mistakes. Then instead of giving him these directions by word of mouth, I wrote them for him in order to thoroughly convince myself that he was able to understand writing. He replied to these questions with perfect correctness. He always wrote very rapidly and did not seem to hesitate to choose his words. He made no mistakes in syntax or orthography. He could understand equally well ordinary writing and print, and when one spoke to him he grasped at once the meaning of the questions, and never wished to have them repeated. I next wrote some most simple words such as "pain," "vin," etc., and urged him

ineffectually to read them aloud. I then pronounced myself some of the words, directing him to repeat them. He appeared to watch with great attention the movements of my lips whilst I spoke; he made some ineffectual efforts to obey, but he never succeeded in pronouncing a single word.'

"This patient died in February, 1882, from an aneurism of the aorta; and a patch of yellow softening was found situated in the posterior third of the third left frontal convolution, and extending for some millimetres only into the white substance."

It will be seen that the kinæsthetic memory-centre was completely destroyed.

If the patient had happened to be an articulo-moteur, there would undoubtedly have been complete verbal amnesia. Taking another point of view — if the lesion had occurred with this patient in the first temporal convolution, the auditory images of words would have been blotted out, and the patient would probably have been incapable of verbal thought.

The two following cases show clearly the different consequences that an affection of Broca's centre may entail. Both cases exhibit jargon-aphasia; but in one, internal language remained intact, while in the other it was distorted.

The first is one of Dr. Osborn's cases, quoted by Bastian in "The Brain as an Organ of Mind."¹

¹ "The Brain as an Organ of Mind," pp. 667 ff. Dr. Osborn's account appears in the *Dublin Journal of Medical and Chemical Science*, Vol. IV, p. 157.

"A scholar of Trinity College, Dublin, twenty-six years of age, of very considerable literary attainments, and well versed in French, Italian, and German, whilst sitting at breakfast, after having bathed in a neighboring lake, suddenly had an apoplectic fit. He was reported to have become 'sensible in about a fortnight,' but, although restored to the use of his intellect, he had the mortification of finding himself deprived of speech. He spoke, but what he said was quite unintelligible, although he labored under no paralytic affliction and uttered a variety of syllables with the greatest apparent ease. When he came to Dublin his extraordinary jargon led to his being treated as a foreigner in the hotel where he stopped; and when he went to the college to see a friend he was unable to express his wish to the gate porter, and succeeded only by pointing to the apartments which his friend had occupied.

"Dr. Osborn, after frequent careful investigations, ascertained the following particulars concerning his patient: —

"1. He perfectly comprehended every word said to him.

"2. He perfectly comprehended printed language. He continued to read a newspaper every day; and when examined proved that he had a clear recollection of all that he read. Having procured a copy of Andral's 'Pathology' in French he read it with great diligence, having lately intended to embrace the medical profession.

"3. He expressed his ideas in writing with considerable fluency; and when he failed it appeared to arise merely from confusion, and not from inability, the words being orthographically correct, but sometimes not in their proper places.

"4. His general mental power seemed unimpaired. He wrote correctly answers to historical questions; he translated Latin sentences accurately; he added and subtracted numbers of different denominations with uncommon readiness; he also played well at the game of draughts.

"5. His power of repeating words after another person was almost confined to certain monosyllables; and in repeating the letters of the alphabet he could never pronounce *k, q, u, v, w, x,* and *z,* although he often uttered these sounds in attempting to pronounce the other letters. The letter *i,* also, he was very seldom able to pronounce.

"6. In order to ascertain and place on record the peculiar imperfection of language which he exhibited, Dr. Osborn selected and laid before him the following sentence from the bye-laws of the College of Physicians, viz. '*It shall be in the power of the College to examine or not examine any Licentiate previous to his admission to a Fellowship, as they shall think fit.*'

"Having set him to read, he read as follows:—'*An the be what in the temother of the trothotodoo to majorum or that emidrate eni enikrastrai mestreit to ketra totombreidei to ra fromtreido as that kekritest.*' The same passage was presented to him a few days afterwards and he then read it as follows:—'*Be mather be in the kondreit of the compestret to samtreis amtreit emtreido and temtreido mestreiterso to his eftreido tum bried rederiso of deid daf drit des trest.*'

"He generally knew that he spoke incorrectly, although he was quite unable to remedy the defect."

It is easy to show that the defective speech was due to some perversion of function in the kinæsthetic verbal centre (*K. V.* in Figure 5). The patient had full possession of internal language; hence one of the verbal memory-centres must have been intact. It could not have been the kinæsthetic centre, for if this had been intact, the patient would have had no difficulty in oral expression. It is evident that the kinæsthetic centre was damaged. If the auditory

centre (instead of the kinæsthetic centre) had been damaged, the patient would have had less difficulty in repeating spoken language, for the cerebral disturbance was manifestly of an incipient nature. With incipient softening or a functional disturbance in the kinæsthetic centre, and with the patient an audile, one would expect the very symptoms that prevailed, — retention of internal language and manifestation of jargon-aphasia.

In the second case there was distortion of the verbal imagery. The case is one of transitory aphasia that befell the writer less than a year ago, — giving him a valuable insight into the subjective aspect of aphasia. As in the case just described, the disturbance was induced by exposure to cold.

The writer was in the Rocky Mountains, crossing a pass at an elevation of 12,000 feet. A violent storm prevailed. There was heavy rain, and a freezing wind against which it was difficult to stand. The writer attempted to communicate with another member of the party, and found to his astonishment that his language was completely unintelligible. It was, in fact, the meaningless jargon of aphasia. For a moment the disturbance was thought to be due to a benumbed condition of the articulative organs; but this belief was quickly dispelled. As soon as the nature of the disturbance was recognized, the writer undertook an introspective analysis of the mental

condition. The results would naturally be more valuable if it had been possible to anticipate the incident and plan the analysis beforehand. As it was, the introspection was improvised under conditions of physical and mental distress attendant upon exposure to cold; and many valuable points that might otherwise have been examined were overlooked. Nevertheless, the results are interesting and instructive.

In the first place, there was no knowledge of the aphasic condition till the attempt was made to speak. The thought-processes had not been in any way embarrassed. The sound of the wind and rain was clearly interpreted, and all visual and tactual impressions carried their proper import. Verbal communications from other members of the party were clearly understood. In short, the perceptual and conceptual processes seemed normal; and it is doubtful whether the aphasic condition would have been noticed if no occasion for speech had arisen. (This seems all the more likely since the aphasia disappeared soon after a more protected part of the mountains was reached. This occurred ten or fifteen minutes after the disturbance was first noticed; and as the thought-processes had not been thoroughly introspected, the writer returned—with more zeal than wisdom—to an exposed position in the pass in order to restore the conditions for the analysis. The aphasia thereupon returned.)

In regard to speech, it was noticed that articulation was somewhat labored and spasmodic; but there was no similitude between the sounds uttered and those appropriate for the expression of the thought. Initial consonants, vowels, and final consonants were jumbled promiscuously, and more than half the words were distorted beyond recognition. Here and there a word was intact, and occasionally only one consonant in a word would be mutilated. The writer could tell immediately whether or not the sounds uttered were appropriate. If a word happened to be pronounced correctly, or was only partly distorted, the fact was immediately recognized.

Introspection showed that verbal thought was an exact counterpart of speech. There occurred the same jumble and confusion in the verbal imagery, and it was impossible to express a thought clearly in internal language. When an attempt was made to translate a visual thought into mental words, nothing resulted but mental gibberish.

As stated, there was, however, no discernible impairment of intelligence. Even abstract thought seemed unaffected, and thoughts were clearly formulated in the mind, although they could not be expressed in mental speech. These thoughts were conducted chiefly in visual and motor imagery.

The visual images were normal and could be re-integrated at will. Visual images of different scenes,

faces, etc., were recalled with normal facility. Thoughts expressed themselves spontaneously in images of sight. In many cases these visual thoughts were saved from oblivion only by a sudden chopping-off of the stream of consciousness. One thought that may be noted can be expressed verbally as follows: "I wonder if they have sheltered in the shaft-house." The thought referred to the other members of the party. It consisted in nothing more than a visual image of these persons taking shelter in the place in question. An attempt was made to express the thought in verbal images, and then in spoken words. In both cases the product was gibberish. The visual images alone carried the meaning, and the verbal images that they would ordinarily have aroused by association refused to be invoked. One point is worth noting: When by dint of persistent effort a few coherent words were at last mentally or orally produced (this occurred when the attack was passing off), these words could usually be mentally or orally repeated. Any considerable pause annulled the possibility.

Unfortunately it was not noticed whether visual images of words could be aroused. If any had appeared spontaneously, they would undoubtedly have been detected.¹ No attempt was made to read or

¹ The writer can ordinarily arouse faint visual images of printed or written words. These images do not usually accompany his verbal thought.

write. This matter was entirely overlooked. No auditory images were present apart from the auditory images in the mental jargon. This mental jargon — like the writer's ordinary verbal imagery — was auditory-motor with practically only the vowel-elements in auditory terms. Motor images of hand- and arm-movements were fairly clear. They were, perhaps, somewhat less definite than under normal conditions. They appeared to be a little "labored," but were still well defined. This impression of labored kinæsthetic images may have been produced by the numbed condition of the body.

The abnormal manifestations of speech gradually disappeared when the writer returned to a more sheltered part of the mountains where he was protected from the severity of the wind. All marked disturbances disappeared within half an hour; but throughout the day there was a decided tendency toward syllable-stumbling. Words were frequently misplaced in the sentence. A severe headache was experienced for several hours after the incident.

The aphasia was undoubtedly induced by cold. The tenuity of the atmosphere could not alone have been responsible for the disturbance, for at other times greater altitudes — with more favorable weather conditions — produced no such effect.

The cerebral disturbance was undoubtedly some functional derangement in the kinæsthetic verbal

centre. This diagnosis was borne out by introspection. When an attempt was made to express a thought in internal language, there resulted a sort of spasm of kinæsthetic images. The motor images of articulative movements had passed out of control: they "exploded" into consciousness instead of rising in the mind in an orderly manner; and they were, moreover, promiscuous and inappropriate. Auditory images of vowels followed the kinæsthetic images of consonants, but since the consonants were inappropriate, the vowels cannot be said to have been either right or wrong.

An analysis of the symptoms shows that the defect could not have been in the auditory centre. An affection of the auditory centre would not be likely to induce jargon-aphasia with the writer, for the leading centre is in his case the kinæsthetic centre. Whatever auditory images exist are aroused by association with motor images of initial articulative movements. In this jargon-aphasia, however, the words *began* incorrectly, the articulative movements themselves being beyond control.

A comparison of this case with the one preceding shows again that disturbances in speech and thought vary according to the prominence of the different types of imagery in the thought-processes. Dr. Osborn's patient was not able to speak, because he could not recall the necessary kinæsthetic images. He was able

to think in words because he could recall words in auditory terms. The writer was unable to speak because he, too, could not recall the kinæsthetic images; but he was unable to think in words because — unlike the former subject — he could not recall these words in auditory terms.

AUDITORY APHASIA

We come now to the consideration of speech-disturbances induced by lesion of the auditory verbal centre,—in the posterior part of the first temporal convolution (*A. V.* in Figure 5). Total destruction of this centre entails obliteration of the auditory images of words. As a consequence there is, of course, complete word-deafness, and the patient understands nothing that is said to him. If the patient is an audile, there is likewise complete verbal amnesia, and the patient cannot think in words. If the person affected should be a marked articulo-moteur, no verbal amnesia need result, for the words are still thought in kinæsthetic images. The patient is then able to read, write, and speak with normal facility. Word-deafness, however, invariably exists.

It must be understood that the word-deaf patient hears quite clearly what is said to him, for even when there is extensive damage to the memory-hemisphere of the brain, the impressions are still received

by the uninjured hemisphere. The words, however, convey no meaning. The patient hears merely a confusion of oral sounds that might as well be words in a foreign language. If the injury to the auditory centre is slight, the word-deafness may be incomplete, and the patient understands here and there a word that is spoken to him, or understands a simple sentence if it is several times repeated. If a severe lesion is restricted to the auditory *verbal* centre, the patient — though completely word-deaf — readily interprets ordinary physical sounds. He understands the significance of a knock at the door, the ringing of a bell, the ticking of a clock, etc., and he recognizes and appreciates music.

As already stated, the severity of the disturbance in verbal thought and speech is dependent upon the degree of prominence of the auditory verbal imagery under normal conditions. The symptoms in different cases are by no means uniform. There may be complete verbal amnesia or no amnesia whatever. The disturbance in speech is, of course, commensurate with the disturbance in internal language, — for the patient cannot speak words that he is unable to think. There may be some amount of paraphasia due to “uncontrolled” activity of the kinæsthetic memory-centre. The speech is paraphasic because there is no auditory imagery to guide it. This symptom is more likely to prevail in ear-minded persons.

The following is a case of auditory aphasia due to destruction of the auditory verbal memory-centre:¹

"A woman, aged 43 years, who had never suffered from deafness or affection of vision, was attacked on June 22, 1880, with right hemiplegia and aphasia. She remained in the hospital until August 4, when she was discharged. At this time the patient could speak, but she spoke unintelligibly, and was sometimes believed to be intoxicated. She not only could not make herself understood, but she could not understand what was said to her.

"She was received into the hospital again on September 10, with slight paresis of the left arm. The right hemiplegia had entirely disappeared. The patient was looked upon as insane. She was absolutely deaf, so that she could not be communicated with."

At the autopsy a lesion was found in the auditory verbal memory-centre. The lesion encroached upon the second and third temporal convolutions. There was a somewhat similar lesion in the right hemisphere, but this would not have affected the verbal memory. — The patient was able to give utterance to oral sounds because the kinæsthetic memory persisted. The speech was defective because there was no auditory imagery to guide it, and because the patient was dependent upon auditory cues.

In the following case (reported by Pick²) it will be

¹ Bastian, "Aphasia and Other Speech Defects," pp. 161 f. Quoted by Bastian from Ferrier, "Lectures on Cerebral Localization."

² *Archiv für Psychologie*, 1892, p. 909. Quoted by Bastian, "Aphasia and Other Speech Defects," p. 166.

seen that the patient was an articulo-moteur, and that there was no verbal amnesia or defective speech despite the fact that the auditory memory-centre was totally destroyed :

"A day laborer, aged 24, was completely word-deaf, and behaved like a deaf person, taking no notice of ordinary sounds near him. It was found that he only noticed loud calls, clapping, or ringing of bells, and this not always readily. Yet if one shouted to him unexpectedly, he said, angrily, 'Don't shout at me so'; and he often said spontaneously, 'I hear quite well, but I don't understand; I can hear a fly flying past me.' His power of recognizing airs previously known to him seemed to be also lost.

"His speech was perfectly correct. He spoke fluently, and only occasionally hesitated about the right word. He named objects shown to him correctly. He could not repeat words or phrases. Writing was executed slowly but quite correctly, though he could not write from dictation. With regard to his power of copying, nothing could be stated, as he could not be persuaded to make the attempt. He read aloud easily and quite correctly, and he understood both print and writing perfectly. Writing afforded the only means of communicating with him apart from gestures. The patient's condition in the above-mentioned respects remained essentially unchanged during the whole period of his stay in the hospital, from January 17 to May 12, 1891.

"At the necropsy the upper parts of both temporal lobes were found to be shrunk, soft, and of a yellow color. On the left side the posterior half of the upper temporal convolution and the supra-marginal gyrus were the parts that were softened. The island of Reil was intact. On the right side there was softening of the upper temporal convolution and a

great part of the second temporal, as well as of the island of Reil, together with some small foci in the lower part of the ascending frontal [precentral], and in the third frontal convolution."

Since the auditory verbal memory-centre was destroyed, the only reasonable explanation for the absence of amnesia and speech-disturbances is that the man was an articulo-moteur, and that verbal images subsisted normally in kinæsthetic terms. Like other people that have no auditory imagery, he would, before his illness, recognize sounds when he heard them, but he would be unable to revive them as acoustic images in his mind. This absence of acoustic images accounts for the absence of speech-disturbances and amnesia when the auditory centre was destroyed. The patient suffered no more in speech than would a congenitally deaf person that had mastered oral language.¹

¹ The suggestion has been made that this patient spoke, like an orally taught deaf person, from visual as well as from kinæsthetic cues. This is highly improbable. One that has made no study of visual speech has practically no optical images of the different positions and movements of his articulative organs. Let the reader verify this statement by endeavoring to obtain visual images of the different movements that his speech-organs would execute in producing the sentences he is at present reading. If he has not made a study of visual speech, he will find these images to be rudimentary to the last degree. He probably cannot tell, without an actual trial, whether in the enunciation of the letter *F*, the upper teeth touch the lower lip, or the lower teeth touch the upper lip. If visual images of speech exist, they will be confined almost exclusively to images of labial action. Physiologists have spent years of pains-

Instances are not at all rare of patients giving utterance to familiar phrases after they have suffered destruction of the auditory memory-centre. The phenomenon shows what an important part the kinæsthetic memory plays in the evocation of speech, — and, with some people, in the thought-processes. The following case, somewhat similar to the one preceding, came under the observation of Hitzig. The report is taken from Bastian.¹

“An old lady, supposed to be suffering from softening of the brain, was at a loss in speaking for a certain number of words, whilst she was also very slightly paraphasic. Nevertheless, she was able to express herself so well that at a first examination no speech trouble might be noticed.

“She was completely unable to understand what was said to her. But after a time, when her condition had somewhat

taking work to ascertain the action of the less observable organs of speech. All this work would have been superfluous if they could have visualized these actions from the beginning. It can be safely stated that the *average* person has visual images of the action of his speech-organs no more than he has visual images of the movements of his diaphragm.

If this laborer had visual images of speech-movements, he should have been a competent lip-reader and should have had no difficulty in interpreting spoken language.

Visual images of printed or written words need not be considered. They cannot incite speech: they arouse the speech-images only by association. The only images that they could arouse in this instance would be kinæsthetic.

It seems clear, then, that in this case the incitatives of speech were kinæsthetic images of articulative movements.

¹ *Loc. cit.*, pp. 329 f.

improved, Hitzig says, 'She took notice when one pronounced certain words, though I believe she did not understand them, but that she recognized rather by analogy the sound of what was uttered, looking to her previous experiences.'

"She had, however, very completely preserved her comprehension of music; she appreciated airs that were sung or whistled; and she herself sang and reproduced airs, though not always very correctly.

"After a time she showed symptoms which pointed to the existence of a new focus of softening — this time in the right hemisphere.

"At the necropsy an area of softening was found in the left hemisphere, occupying principally the temporal lobe and more especially the posterior two-thirds of the first temporal convolution. This old softening was probably the cause of her word-deafness. In the right hemisphere there was a symmetrical focus of recent date in the temporal lobe."¹

It will be seen from the nature of the lesions that the auditory images of words must have been destroyed; yet the patient gave utterance to complete sentences. As a rule, intelligent speech is inhibited by a lesion in the auditory verbal centre, and it is only in rarer instances that the patient gives expression to several words in rational sequence.

¹ A somewhat similar case is reported by Wernicke in "Der Aphasische Symptomencomplex." This is quoted by Ballet, "Le langage intérieur et l'aphasie," 2d ed., p. 86; and by Wyllie, "Disorders of Speech," p. 285.

THE RELATION BETWEEN MOTOR AND AUDITORY APHASIA

It might be profitable to consider at this juncture the points of similarity and difference between motor and auditory aphasia. These points may best be studied under three headings: the reception and interpretation of speech; the retention of the verbal images in memory; and the expression of oral speech.

The Reception and Interpretation of Speech.—In auditory aphasia, the word-deafness is always commensurate to the amount of damage in the auditory verbal centre. When destruction of the centre is complete, the word-deafness is complete. If only part of the centre is destroyed, or if the whole centre is enfeebled rather than annihilated, the patient may interpret an occasional word that he hears, or may grasp the meaning of a whole phrase if it is several times repeated to him. If the patient happened to be an orally taught deaf person, it is evident that a lesion in the first temporal convolution would have no injurious effect upon speech; the integrity of this centre would not be necessary, since the patient would interpret speech entirely by vision.

It seems at first sight that there should be no word-deafness with pure motor aphasia, since the auditory word-images are not affected. No word-deafness

occurs with the audile, but the articulo-moteur may have difficulty in interpreting spoken language. However, he gathers the meaning when the words are slowly and clearly uttered, or he understands them when they are repeated. When the *auditory* centre is destroyed, the word-deafness is, on the other hand, complete.

The Retention of the Verbal Images in Memory. — The amount of amnesia that exists with a lesion in the auditory or kinæsthetic memory-centre varies with the prominence of the different types of imagery in verbal thought. The audile has his internal language annihilated if an injury occurs to the auditory verbal centre. On the other hand, the articulo-moteur or the orally taught deaf person finds that his internal speech is practically unaffected by such a lesion. When an injury occurs to Broca's centre, it is the articulo-moteur that suffers: his verbal memory is expunged. The pure audile — Guido Banti's patient is an example¹ — thinks in words as freely as ever.

The audito-moteur suffers when *either* centre is affected, the degree of the amnesia varying, of course, with the individual. Wyllie believes that verbal amnesia is common with motor aphasia. He says:

"There is reason to believe that in every case of severe motor aphasia that is due to destruction of the motor images, Amnesia

¹ See p. 126.

Verbalis is extremely well marked, — even more so, perhaps, than it is in severe cases of auditory aphasia.”¹

Collins expresses a similar opinion :

“Patients with cortical motor aphasia often show great amnesia and lack of comprehensive grasp of facts that have been communicated to them since their illness.”²

The Expression of Oral Speech.—The impairment of oral speech is proportional to the amount of kinæsthetic amnesia that exists. If destruction of Broca’s centre is complete, the patient becomes mute even though he may think clearly in auditory images of words. Frequently a few of the brain-cells seem to escape damage, and the patient gives expression to such recurring utterances as “tan-tan,” “list complete,” etc. When the impairment of the kinæsthetic centre is functional rather than organic, or when the lesion is slight, the patient may exhibit a considerable degree of jargon-aphasia or paraphasia. He gives utterance to meaningless syllables when he attempts to speak, or uses words that are entirely inappropriate.

When the auditory area is affected, the patient’s ability to speak is proportional to his ability to summon the kinæsthetic images of words independent of his images of hearing.³ With Pick’s patient we see

¹ “Disorders of Speech,” p. 312.

² “The Faculty of Speech,” p. 173.

³ On this subject Starr writes as follows : “If, in the patient with word-deafness, there is no accompanying word-blindness, he may

that there was full ability to recall these images of feeling.¹ With the audile, no such ability would be likely to exist, and the patient would be unable to give utterance to intelligible speech. At best there would be paraphasia and jargon-aphasia, due to the uncontrolled activity of the kinæsthetic centre. With a partial disablement of the auditory centre, paraphasia is likely to result. The degree of jargon-aphasia is determined largely by the severity of the lesion.

When the auditory area is enfeebled rather than destroyed, the patient can usually repeat words that he hears spoken. This matter will be discussed subsequently at greater length.

The cases of aphasia cited in the preceding pages are typical of disturbances that occur with degeneration in strictly delimited cortical areas. It frequently happens, however, that a lesion covers only part of a

be able to read aloud as well as to himself — that is, his motor speech memory may be aroused by way of his visual memories without the intervention of the auditory memories. And if he has no apraxia [loss of concepts] it is also possible for any of the concept memories to awaken the motor speech memory; hence the thought of an object or seeing it may lead to the enunciation of its name without thought of how the name sounds. For this reason patients who are word-deaf and cannot understand what is said to them may be able to talk fairly well." ("Organic and Functional Nervous Diseases," 2d ed., pp. 456-457.)

¹ pp. 139 f.

particular centre. The function is then only partially inhibited. In other cases the lesion falls along the borders of two adjoining centres. It then happens that there is impairment of both faculties, but subversion of neither. In other cases, again, the lesion may be more extensive and may affect two or three centres simultaneously. Several subjective disturbances, such as auditory and visual amnesia or word-deafness and mind-blindness, then coexist, and the patient's intelligence is reduced to a minimum.

ASSOCIATIONAL APHASIA

Lesions producing aphasia are not necessarily situated in the cerebral cortex; they are frequently found in the association-tracts uniting the different centres of the brain. As already stated (p. 115), a lesion severing the fibres between the primary visual centre and the visual verbal memory-centre will produce word-blindness without agraphia. The patient cannot read because the visual impressions do not arouse their associated memory-images. These memory-images can, however, be aroused spontaneously, and they are at the service of the patient when he desires to write. He writes spontaneously or from dictation, but he cannot read what he has himself written.

It has already been explained that in such cases the patient sometimes manages to read in a rather crippled

way by tracing the letters with a pen or with his finger. In these cases the kinæsthetic sensations arouse the visual images of the words, and the process is exactly the reverse of that which takes place during the act of writing.

All ideas that are associated by contiguity can thus arouse one another mutually. The association, as already stated, is stronger in the direction representing the order of the occurrence of the impressions; but it exists in the other direction none the less. Pathological phenomena show that the association-fibres conducting stimuli from one centre to another are not the same as the fibres conducting stimuli in the reverse direction; in other words, the association-tracts are double. Since contiguous association can take place between *any two ideas*, one naturally concludes that there must be double association-tracts between any two brain-centres that may be designated.

A peculiar condition, known as *optic aphasia*, is produced by interruption of the fibres that convey stimuli from the visual memory-centre to the verbal memory-centres. There is no object-blindness. The patient recognizes objects with facility: but the stimulus cannot pass to the verbal memory-centres; hence the patient is unable to recall the names of objects that he sees. When the object is made to appeal to another sense — touch, hearing, or taste, for instance — the patient is able to name it immedi-

ately. He might, of course, do the same thing if he suffered from pure object-blindness; but since there is no object-blindness present and no amnesia (for the name can be aroused through other channels), it follows that the difficulty is merely one of association.

If the lesion happened to occur in the set of fibres that convey stimuli from the auditory word-centre to the visual memory-centre, there would result — in the eye-minded person, at least — a marked degree of word-deafness. The subject would hear the words, but the words would not arouse their visual associates; hence in many instances they would not be understood. The condition would differ little from word-deafness produced by degeneration of the auditory centre. There would, however, be less disturbance in physical speech.

Theoretically there are as many different associational disturbances as there are association-tracts in the cerebrum. Many pathological cases have been recorded that bear out the different classifications. But most of these cases show complications due to the encroachment of the lesions upon other parts of the cerebrum, and in many instances, too, no autopsical examination has been recorded; hence it would not be profitable to consider these cases at length. The characteristic symptoms of any particular case should be obvious from what has already been said concerning association and the nature of aphasia.

A few remarks, however, may be made concerning the defects of speech that result from a breach in the fibres uniting the auditory and kinæsthetic word-centres. These fibres cross the Sylvian fissure, passing beneath the island of Reil. Undoubtedly they are double, but owing to their propinquity they are not likely to be separately damaged. The nature of the disturbances attendant upon damage to these fibres is determined by the relative prominence of the two centres in the verbal processes. A pure articulo-moteur would suffer no disturbance in oral expression. Speech would be initiated from Broca's centre, and the isolation of this centre from the auditory region would have little significance. The audito-moteur or audile (the audile, of course, becoming an audito-moteur where oral expression is concerned) exhibits jargon-aphasia or paraphasia from a similar lesion. There is usually no word-deafness, or no more word-deafness than would result from destruction of the kinæsthetic centre. Internal language is not impaired in the pure audile or pure articulo-moteur, though naturally it becomes affected in the audito-moteur if he is not able, after the occurrence of the lesion, to restrict his verbal thought to one particular type of imagery.

The following is a case of paraphasia due to interruption of the audito-kinæsthetic association-tract: ¹

¹ Collins, "The Faculty of Speech," p. 418. The case was originally reported by Lichtheim.

"A man, forty-six years old, with incomplete right-side hemiplegia. No history could be obtained. Examination showed that the patient understood spoken, written, and printed speech. The most remarkable feature of the case was paraphasia, which was so great that spoken speech was quite unintelligible. He was aware of the mistakes in his production and tried to assist himself by pantomime. Writing was very imperfect; he disarranged the order of the letters and the words, and it was difficult to get him to make efforts of writing. The same defect was manifested in attempting to repeat as when he endeavored to speak voluntarily. He retained the ability to copy. The autopsy showed extensive lesions, the chief one, according to the writer, being of the island and of the floor of the Sylvian fissure."

The symptoms vary greatly in different cases; hence the foregoing case cannot be said to be typical. The paraphasia indicates impairment of internal language or the existence of complications affecting the visual area or fibres connected with it.

When damage occurs to the projection-fibres leading from the motor areas of the brain, the resultant disturbance is aphemia. The symptoms are identical with those produced by a lesion in the motor cortex. Internal language is, of course, unaffected.

AMUSIA

Amusia is a generic term for disturbances in the musical faculty. These defects are quite analogous to the various forms of aphasia. We find tone-deaf-

ness, note-blindness, musical amnesia, etc., analogous to the different defects in speech. Defects in the musical and speech faculties may coexist or exist independently of each other.

The independent occurrence of disturbances in the musical faculty points to the existence of a separate centre presiding over the musical memory. The facts of development carry similar import.

"Musical recognition in childhood often precedes verbal recognition.¹ Musical expression usually precedes verbal expression, both when there is clearly inherited musical tendency, and in ordinary imitative reactions."²

The disparity in the development of the musical and speech faculties is often remarkable. Ballet states³ that Stumpf's child could sing the scale correctly at the age of fourteen months. He cites further the case of the son of the composer, Dvorak, who at one year could sing with his nurse the march from "Fatinitza." At eighteen months he could sing his father's songs, the latter accompanying him on the piano. The faculties of speech and song frequently interfere with each other's development. The writer has a nephew that developed a remarkable propensity for singing at the age of two. When less than

¹ Verbal recognition of course requires the establishment of associations. — C. S. B.

² Baldwin, "Mental Development of the Child and Race," p. 440.

³ "Le langage intérieur et l'aphasie," 2d ed., p. 24.

two and a half, he could sing accurately the melody of "La donna e mobile," from "Rigoletto." But when the musical faculty began to develop, all attempts at speech seemed to disappear. At the age of three the child began to employ words again, but he had then no more command of language than he had at eighteen months.

This independent development of the faculties would scarcely take place if the musical and auditory verbal memories were subserved by the same centre. Physiologists are pretty well agreed that the auditory musical memory resides in the anterior portion of the first temporal convolution. The posterior two-thirds, it will be remembered, presides over the auditory memory for spoken words. When the whole superior temporal convolution is damaged, there result both amusia and aphasia. When the lesion is limited to the anterior portion, there occurs amusia without aphasia. When the damage is restricted to the posterior portion, aphasia alone results.

The visual memory for musical notations seems to reside in a different portion of the cortex from that presiding over the memory for ordinary letters. The visual images pertaining to music are probably stored in the general visual centre.

Tone-deafness is usually accompanied by musical amnesia. Lack of musical imagery is normal with a large proportion of the race. A certain amount of

natural tone-deafness is likewise common, a great many people being unable to appreciate intricate classical music. Pathological tone-deafness results, of course, from actual degeneration in the cerebrum, and it is often accompanied by word-deafness. Collins¹ cites a case, originally reported by Sérieux, in which there was total word-deafness. In addition, "The most familiar tunes when played on any instrument were not recognized. 'Au Claire de la Lune,' was said to be a 'dead march.' Café chantant music was designated church music, etc."

"Lichtheim has reported a very instructive example of amusia. His patient was a teacher and journalist, who became completely word-deaf after a second attack of apoplexy. Communication with the patient could be made only in writing. He heard when one sang or whistled, but he did not recognize the melodies. Concert singing by his children was most annoying because it was 'so noisy.' The most familiar melodies, such as 'Rufst du mein Vaterland,' were not recognized."²

Dr. Brazier cites a number of interesting cases of amusia.³ In one case a tenor in the comic opera was suddenly stricken with musical amnesia during the performance. He was unable to understand what was being sung, and was himself unable to produce

¹ Collins, "The Faculty of Speech," p. 260.

² Collins, *loc. cit.*, p. 260.

³ "Du trouble des facultés musicales dans l'aphasie," *Revue philosophique*, October, 1892, pp. 337-368. Reviewed in *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*, Vol. 5, pp. 345 ff.

a note. He could speak with fair fluency, but had forgotten the words and music of his songs entirely. The disturbance disappeared after several months. In another case a well-known pianist was playing a piece from memory, with orchestral accompaniment. Suddenly he forgot the piece, and the music of the orchestra appeared to him as a mere confusion of sounds. There was no trace of aphasia. It is evident that the disturbances in musical expression were due in these two cases to the loss of auditory musical memory.

The musical memory is not necessarily auditory, though of course it usually takes this form. For instrumental music, the memory may be visual or motor. The visile may learn a piece of music by visualizing the notes, and he would naturally depend upon his images of sight. The motile can learn to play pieces from memory, even if he has no acoustic imagery. Any disturbance in his kinæsthetic imagery of hand-movements would then interfere with musical expression. It will be remembered that one of Charcot's patients had lost the memory for associated movements of the hands and mouth necessary for playing the trombone. In such cases musical expression would be impaired even if the auditory memory were unaffected.

Conditions of note-blindness (called also *musical alexia*) and musical agraphia occasionally occur.

When the damage causing the disturbance is limited to the visual area, the patient may still play well by ear. Kussmaul¹ refers to a patient of Finkelnburg's that could play well by ear, though he had lost the power of interpreting written music. A patient of Lasègue's¹ that suffered from aphasia and agraphia was able to write the notes to any melody he heard. A patient of Proust's¹ could compose and write music, but was totally unable to play from notes. This disturbance was probably produced by a lesion in the fibres uniting the primary and secondary visual centres. Such a lesion would account for the absence of musical agraphia, since the visual memory-centre would be unimpaired.

THE ABILITY OF AN APHASIC PATIENT TO SING

Returning to the subject of vocal music, we find that the patient is usually unable to sing when he is unable to speak. However, he may still be able to hum or whistle airs with the greatest accuracy, or he may sing by attaching musical sounds to a few meaningless syllables that he is still able to articulate. But it occasionally happens that an aphasic patient can sing *words* that he cannot express in ordinary speech. In such cases the defect of speech is undoubtedly due to auditory amnesia, the kinæsthetic word-images being unimpaired. A case of this nature

¹ See Kussmaul, "Störungen der Sprache," 4th ed., p. 193.

is recorded by a writer in the *Psychological Review*.¹ He says:

"A patient now under his observation [the author writes in the third person] with total loss of the power of speaking, the understanding of speech being preserved, is being successfully taught to sing in a high pitch words which he cannot be taught to say."

Bastian quotes a case from Knoblauch, in which the patient could sing words that she could not pronounce:²

"The patient was a girl, aged six years, who could neither read nor write. After recovering from an attack of scarlet fever followed by nephritis, she was seized with general convulsions on December 21, 1886.

"On December 26 consciousness slowly returned, but there remained a condition of right hemiplegia with aphasia. The child could not speak at all at first. Later on she said "Mamma," and apparently *repeated* a few words. She could sing the song "Weisst Du wie viel Sternlein stehen," etc., but she could not recite the text of the song, or speak voluntarily single words of the same.'

"Soon after she improved in general health, but on February 8, 1887, she was admitted into the Clinical Hospital at Heidelberg on account of the hemiplegia and the speech defects. In regard to the latter the following details are given: 'Mentally, as far as one can judge, she is very well developed. As she is aphasic she has to make herself understood by gestures; spontaneously she only utters "Mamma." She is *able to repeat a few words*, but very imperfectly. If one commences the song

¹ Vol. 1, No. 1, January, 1894.

² Bastian, "Aphasia and Other Speech Defects," p. 288.

"Weisst Du wie viel Sternlein stehen," she sings it with the right melody in an automatic way, being unable either to continue or to begin afresh when she once stops. All the words of the text which she is unable to pronounce spontaneously are, while she sings them, articulated perfectly. The comprehension of spoken language is quite normal. The patient has not yet learnt to read or write.'

"After this date she improved remarkably under treatment, so that by February 21 'she was able to *repeat most words correctly*, with considerable trouble it is true. She could count up to three if some one started her with "one." In the beginning of March she was able to sing the song "Weisst Du wie viel Sternlein stehen" quite alone, and certainly with a much purer intonation than at the beginning of the treatment. On March 8, she succeeded for the first time in reciting the text of the song without singing the melody. In the beginning of April the patient had acquired a considerable vocabulary, and she even attempted to form small sentences. In the middle of the same month she could utter almost all words, but could not yet form connected sentences, though she managed to make herself perfectly understood.'"

Bastian gives an account of another case, which came under his own observation. The patient was a woman, aged forty. When admitted to the hospital (October 1, 1897) she was completely word-blind and almost completely word-deaf. Her condition later was as follows:¹

"November 25. Examination by the House Physician (Dr. J. S. Collier). No word-deafness now. She corrects me directly when I make a mistake in the multiplication table.

¹ Bastian, *loc. cit.*, pp. 291 f.

The only words she uses voluntarily are 'no,' which she uses correctly, and 'Bull,' the name of the patient next to her. If the alphabet be repeated slowly to her she joins in and will continue to repeat it alone correctly. Sometimes, however, she makes a mistake, shakes her head and says 'no,' and cannot continue until she is started afresh. When started by counting aloud, she can count up to twenty alone, with some defects of articulation, such as 'en' for ten, 'fixteen' for sixteen, 'tenty' for twenty. She cannot say the easier part of the multiplication table. She cannot repeat a single word after me. She was made to say 'eighteen, nineteen, twenty,' about a dozen times by leading up with 'sixteen, seventeen,' repeated by me aloud, and then when I asked her to say 'twenty' she did so at once, but could not repeat the performance.

"She can sing a tune to order. She commences humming and then joins in with the words, many of them perfectly articulated, some of them badly articulated, and in the place of others mere lalling. The following is a specimen of her singing of the hymn 'Hark, hark, my soul,' her mistakes being printed in italics.

'Hark, hark, my soul, angelic songs are swelling

O'er earth's green *eas* (seas) and ocean's *nave mint ore* (wave-beat shore),

How sweet the truth those blessed strains are *selling* (telling)
Of that new life where sin shall be no more.'

"She sang three verses of this hymn. She also sang to order verses of the following hymns: — 'Onward, Christian soldiers'; 'Jesu, meek and gentle'; 'Awake, my soul'; 'At even ere the sun was set'; and others, as well as some popular ballads, such as 'Belle Mahone'; 'Cherry ripe,' etc.

"She can start singing these herself. She can, moreover, repeat the above mentioned verses without singing if she is started by my beginning them aloud, but she cannot say them

without being first put upon the track. Her articulation of quite difficult words in the singing is often very good, but in repeating poetry her articulation is not so good as when she sings.

"She cannot repeat a single word dictated to her.

"She is still absolutely word-blind. She names letters but quite wrongly. When shown a letter upside down, she at once placed it right side up. When shown her own name she evidently did not recognize it; she spelt it out, but did not get a single letter right, thus —

S a r a h B r o w n
i p t e a e a v r n o

"December 11. She is still completely word-blind; she cannot pick out a single letter, or recognize her own name spelt with capitals. She has said a few more words spontaneously, such as 'oranges' and 'fish.' She still cannot name any object that is shown to her. She can now *repeat* words a little, such as 'father,' 'paper,' 'nice,' — has done so about a dozen times in all. She understands complicated orders at once, and obeys correctly."

It will be seen from the foregoing report that the patient was practically devoid of spontaneous speech, though she was able to sing with considerable facility. The fact that she could count, and recite words in a quasi-automatic manner, is not surprising. This phenomenon is often seen when the defect occurs in the auditory centre. The words are produced mechanically, and they do not represent verbal *thought* in the true sense of the word. When the answer to a question requires the enunciation of a simple number, the patient frequently remains mute, — even

though he may be able to count in a mechanical way. Singing may be easier for these patients because it is a mechanical rather than a thought process.

TRANSITORY APHASIA

Aphasic attacks are often transitory, lasting for minutes, hours, days, or even months. These attacks are due to functional disabilities rather than to lesion of the cerebral tissue.

Daly records a case¹ in which there were recurring attacks of transitory aphasia with right hemiplegia. In one day there were as many as ten attacks, varying in length from ten to sixty minutes. The patient would suddenly say, "I am all right again," and the attack would be at an end. The power in the hemiplegic limbs returned almost as soon as the faculty of speech. Bastian suggests that the attacks were due to spasms of the cerebral blood-vessels induced by uræmic poisons in the blood.

Ballet² states that he has frequently induced temporary attacks of aphasia in himself by excessive tobacco-smoking. He ascribes the affection to a disturbance of the kinæsthetic memory. He has found his auditory and visual verbal images to be clear at such times, though the words themselves could not be pronounced.

¹ Quoted by Bastian, *loc. cit.*, pp. 116 f.

² "Le langage intérieur et l'aphasie," 2d ed., pp. 118 f.

Trousseau records the case¹ of Professor Rostan, who experienced an attack of temporary aphasia. He was confined to his bed for several days by an injured leg, and fatigued his brain by excessive reading. When the attack came on, he noticed that he did not clearly understand what he was reading. When he tried to call for assistance, he found that he could not utter a word. He was also unable to express his thoughts in writing. He was bled, and he then found that he could say a few words. The recovery was gradual, and at the end of twelve hours was complete.

In another case² a minister found himself aphasic one morning, after being exposed on the previous evening to the night air and receiving "a check to the cutaneous perspiration." The patient understood everything that was said to him, but was himself unable to utter a word. When he attempted to express himself in writing, he wrote the meaningless phrase, "Didoes doe the doe." He was bled of fifty ounces of blood; thereupon he recovered rapidly.

Kussmaul³ records the case of a thirteen-year-old girl that remained aphasic for thirteen months, — the effect of being run over by a vehicle. She re-

¹ Cited by Bastian, *loc. cit.*, p. 115.

² Bateman, "On Aphasia," 2d ed., p. 83; quoted by Bastian, *loc. cit.*, pp. 115 f.

³ "Störungen der Sprache," 4th ed., p. 213.

ceived no severe injuries, but remained speechless from the shock. After various specifics had proved ineffectual she was treated with potassium bromide. One day, after taking the medicine, she threw herself in her mother's arms, and whispered, "Mother, I am going to speak again." In a few weeks she had completely recovered her lost faculty.

Intense emotional excitement sometimes induces temporary attacks of aphasia. Anger or fear may leave a person speechless for days. Todd¹ refers to the case of a man of irritable temperament who became so excited during a conversation that he completely lost his power of speech. He remained aphasic for a week.

The power to "speak with tongues," which accompanies religious ecstasy and is frequently regarded as a supernatural manifestation, is doubtless nothing more than a passing attack of jargon-aphasia.

LOWERED EXCITABILITY OF BRAIN-CENTRES

Aphasia frequently results from functional weakness of the verbal centres. In such cases it usually takes the form of amnesia without word-deafness or word-blindness. (Defects of this nature are likewise common when there is incipient softening in the cerebrum.) The patient forgets first the names of things

¹ "Clinical Lectures on Diseases of the Brain," p. 278; cited by Bastian, *loc. cit.*, p. 124.

that he can think of in visual terms; hence the names of concrete objects are the first to go. Abstract nouns, verbs, prepositions, etc., usually have the *verbal* image as the nucleus of the concept; hence the verbal image is in this case less readily displaced. Amnesic defects are often induced by causes that affect the cerebrum only indirectly; they operate by lowering the general vitality of the nervous system. Such causes are old age, extreme fatigue, debilitating diseases, etc.

Trousseau has recorded in his Lectures a case of amnesia due to lowered vitality of the verbal centres:¹

“You remember the experiment that I often repeated at Marcou’s bedside. I placed his nightcap on the bed and asked him what it was. But after looking at it with close attention he could not tell what it was called. He would exclaim, “And yet I know well enough what it is, but I cannot recollect.” When I told him that it was a nightcap, he would reply, “Oh, yes! it is a nightcap.””¹

The same thing occurred when he was tested with other objects. He could seldom name them, but he recognized the names when they were mentioned. In two minutes the name was again completely forgotten. In this case the sole disability was amnesia. The patient recognized words and could repeat them; but owing to the enfeeblement of the verbal centres he could not arouse the word-images spontaneously.

¹ Ballet, “Le langage intérieur et l’aphasie,” 2d ed., pp. 80 f.

Wyllie quotes a similar case in his "Disorders of Speech."¹

The patient, a man aged twenty-seven, sustained a fracture at the base of the skull. There was some disturbance in vision, and a slight "motor paresis" in the right side of the body. At first there was word-deafness, but this soon passed off.

"The peculiar feature of the case has yet to be stated. It was a most remarkable shortness of memory for objects seen, and for words seen or heard. The sound-image of a word, or the visual image of either a word or an object, could easily be revived from without, and its revival called up the corresponding idea or meaning in the normal way; but, as to visual images, immediately when the object or word was withdrawn from the patient's sight its image vanished, and he totally forgot what object or word he had been looking at; and so also as to sound-images, he heard the word spoken to him and understood it, but immediately forgot it, and could not repeat it, even if only a very short interval was allowed to elapse before he was asked to do so.

"Shown a knife, he knew what it was, and, if he could not recall the noun 'knife,' he said it was something for cutting with; but if the knife was then placed among other objects, and covered from his sight for a moment, he could not, when the collection of objects was again uncovered, tell which of them had been shown to him.

"It was the same with visual images of letters and words. Shown, for example, the letter G cut out in wood, he easily recognized it; but if it was then covered from his sight, and

¹ "Disorders of Speech," pp. 384 f. The case is recorded by Professor Grashey, *Archiv für Psych.*, xvi, 1885, p. 645.

placed among other wooden letters, he immediately forgot what letter he had seen, and failed to pick it out from among the others, unless he kept repeating to himself 'G, G, G,' and thus artificially retained it in his memory.

"And it was, again, the same with the sound-images of words. He could repeat or echo any word spoken to him, but the memory of it immediately vanished, if he did not retain it artificially by repeating it over and over again."

In this case, again, it is evident that there was no destruction of the brain-cells. The defects were due merely to lowered excitability of the centres.

THE ABILITY OF AN APHASIC PATIENT TO REPEAT

When the disturbances producing aphasia are situated in the auditory verbal centre, and when the cortical cells are not destroyed, the patient can usually repeat words that are spoken in his hearing. He may possess this ability even when he can utter scarcely a word spontaneously. The ability of the patient to repeat words can be regarded as an indication of the integrity of the kinaesthetic memory-centre.

Instances are numerous in which aphasic patients have been able to pronounce words spoken in their hearing. It will be remembered that the little girl that could sing when she could not speak spontaneously, "was able to repeat most words correctly" (p. 158). Even when she sang "Weisst Du wie viel Sternlein stehen," she had at first to be accompanied, or some one had to commence the melody for her.

The explanation for a patient's ability to repeat when unable to speak spontaneously is most probably that the cortical cells are too much enfeebled to permit the spontaneous evocation of the auditory image, but not sufficiently weakened to resist the auditory impression. The sensory stimulus overcomes the inertia of the cells, and while the primary memory endures, the patient is able to repeat the words that he could not otherwise pronounce. The phenomenon sometimes takes the form of *echolalia*, and the patient reëchoes almost any word that he hears, frequently attaching no meaning to it.

This condition was observed in one of Collins' patients that suffered from word-deafness, word-blindness, and object-blindness. Part of the report of the case is subjoined:¹

"Examination of this patient eight months later reveals practically the same condition as above stated, save that the word-deafness is, if changed at all, more complete. The hemianopsia is very difficult to demonstrate, and, if it exists, it is very slight. The only change of any import is a marked echolalia that he has developed. If one says, 'How old are you?' he repeats over and over, 'You, you,' with a rising inflection on the last letter. 'How is papa?' 'Papa, papa,' repeated and repeated. Usually he takes the last word of the sentence that he hears and echoes it, occasionally the last two words. Such as, 'Will you have an orange?' 'An orange, an orange,' he repeats — the 'an' with great vigor and clearness of enunciation

¹ Collins, "The Faculty of Speech," pp. 257-258.

and with a rising inflection on the last syllable of orange. Complex words he occasionally attempts to echo, but he does not succeed in so doing. There is still a degree of that condition known as mind-blindness, but it is not so conspicuous as when he was first seen."

Referring to echolalia, Bastian says:¹

"A defect of this kind (occurring in a woman who was hemiplegic from cerebral hæmorrhage) has been recorded by Professor Béhier.² She was born in Italy, and had resided both in Spain and France; of the three languages she had thus acquired she had completely forgotten the Italian and Spanish, and had only retained a most limited use of French. In this latter language *she only repeated like an echo* the words pronounced in her presence, without, however, attaching any meaning to them. But in the case of a woman seen at the Salpêtrière by Bateman the mimetic tendency was much stronger. She even reproduced foreign words with which she has never been familiar."

Many cases are recorded in which patients reiterate words without understanding them. Their failure to understand words that they are themselves able to enunciate is due to the involvement of other areas besides the auditory centre. If the visual memory-centre were destroyed in an eye-minded person, the visual associates of the word-images would be abolished, and the words would be practically destitute of meaning. Many words would retain their meaning by

¹ "Aphasia and Other Speech Defects," p. 152.

² *Gazette des Hôpitaux*, May 16, 1867.

virtue of associated images of touch, hearing, etc. ; but those that are usually associated with visual images would fall meaningless upon the ears of the person affected. Thus there may ensue a degree of word-deafness from impairment of the visual memory-centre.

This last condition, impairment of the visual memory-centre (often with associated defects in the auditory centre), is probably the defect that exists in those few cases in which the patient is able to repeat words spoken by another person and understand them when he has himself pronounced them. The auditory impressions are of themselves unable to arouse the visual images in the partially damaged centre ; but when the auditory impressions are reinforced by the kinæsthetic sensations, the conjoint stimuli are able to overcome the inertia of the damaged cells. Another possible explanation is that the fibres conveying stimuli from the auditory to the visual centre are damaged, and that the stimuli reach the visual centre indirectly through the kinæsthetic word-centre. This explanation is open to the following criticism : The kinæsthetic verbal images must be present before the words can be orally produced. If these images can be aroused by the sound of the words, there seems no reason why they should not excite the visual images directly, without first expressing themselves in oral speech. This criticism is not easily

answered. The facts seem to be that the torpid cells are excited only by the summation of stimuli from two different sources. This principle of the *summation of stimuli* is thoroughly established in psychology; and it is one that should be particularly noted at this point, since we shall revert to it in succeeding chapters. Where a single stimulus is unable to produce a given response — a movement, the arousal of a mental image, etc. — the response is often produced by the cumulative effect of several different stimuli. As already suggested, this probably happens when the word-deaf person is able to understand words after he has repeated them, — the word-deafness being occasioned by torpidity of the general visual centre as well as of the auditory verbal centre.

THE ABILITY OF AN APHASIC PATIENT TO READ ALOUD

The principle of the summation of stimuli is exemplified in many aphasic (or amnesic) patients that are able to assist themselves by visual stimuli. The verbal centres may be too weak to permit the spontaneous recall of words, but they nevertheless respond when there is an additional stimulus from the visual centre. Thus it is sometimes found that a patient can read aloud, though he cannot express himself spontaneously. In some such cases it is probable that the kinæsthetic verbal centre is excited directly from the visual verbal centre without the intervention of

the auditory centre. The images of articulatory movements are then aroused directly by association.

Graves¹ records an interesting case in which an amnesic patient assisted himself by visual stimuli:

"The man was a farmer, aged 50 years, who had suffered from a paralytic attack from which he had not recovered at the time of observation. The attack was succeeded by a painful hesitation of speech. His memory was good for all parts of speech except noun-substantives and proper names; the latter he could not at all retain. This defect was accompanied by the following singular peculiarity: he perfectly recollected the initial letters of every substantive or proper name for which he had occasion in conversation, though he could not recall to memory the word itself.

"Experience had taught him the utility of having written on manuscript a list of the things he was in the habit of calling for or speaking about, including the proper names of his children, servants, and acquaintances; all these he arranged alphabetically in a little pocket dictionary, which he used as follows: if he wished to ask anything about a cow, before he commenced the sentence he turned to the letter C, and looked out the word 'cow,' and kept his finger and eye fixed upon the word until he had finished the sentence. He could pronounce the word 'cow' in its proper place so long as he had his eye fixed upon the written letters; but the moment he shut his book it passed out of his memory and could not be recalled, although he recollected its initial, and could refer to it when necessary. He could not even recollect his own name unless he looked out for it, nor the name of any person of his acquaint-

¹ *Dublin Quarterly Journal*, 1851. Case quoted by Bastian, "Aphasia and Other Speech Defects," p. 148.

ance; but he was never at a loss for the initial of the word he wished to employ."

In a somewhat similar case recorded by Abercrombie¹ the patient resorted to visual impressions to assist himself in interpreting spoken language:

"His mental faculties were so entire that he was engaged in most extensive agricultural concerns, and he managed them with perfect correctness by means of a remarkable contrivance. He kept before him in the room where he transacted business a list of the words which were most apt to occur in his intercourse with his workmen. When one of them wished to communicate with him on any subject he first heard what the workman had to say, but without understanding him further than to catch the words. He then turned to the words in his written list, and whenever they met his eye he understood them perfectly."

This is a case in which there must have been summation of stimuli — even if we suppose the patient to have been a typical visile. He would find at best only one or two words in his written list, but these would add their weight to the auditory impressions and assist in overcoming the inertia of those cells whose torpidity isolated the acoustic sensations.

Lichtheim records a case² in which the patient was able to read fluently, although he was aphasic for spontaneous speech. The patient could *repeat* quite

¹ "Inquiry into the Intellectual Powers," 7th ed., p. 158. Cited by Bastian, *loc. cit.*, p. 158.

² *Brain*, 1885. Quoted by Bastian, *loc. cit.*, p. 150.

accurately, so it is plain that the cause of the speech-disturbance was merely a diminished excitability of the auditory centre. The patient was a medical practitioner that had become aphasic as the result of a carriage accident. There was paresis in the right arm and leg.

“Speech was much affected; the first day the patient said only ‘Yes’ or ‘No,’ but quite appositely. Gradually more and more words returned, at first imperfectly. Whilst his vocabulary was still very meagre, it was observed that he could *repeat* everything perfectly. Soon after the accident he began to read with perfect understanding. It was established beyond doubt that he could read aloud perfectly at a time when he could scarcely speak at all. The statements of his wife are most positive and trustworthy upon this point, though he himself does not recollect what took place just after the accident. She states that after much difficulty in making himself understood by gestures he obtained a newspaper, and to the great astonishment of all present he began to read fluently. She herself thought it most strange and inexplicable. . . . He could not write voluntarily at all; but this faculty returned slowly and imperfectly, as did speech. On the other hand, he could, soon after he left his bed, copy and write from dictation.”

Bastian reports two similar cases in “The Brain as an Organ of Mind.”¹ Both patients were aphasic for spontaneous speech. Neither could repeat very readily; yet both could read with facility, — one, indeed, evincing no trace whatever of his speech-defect when reading. In these cases it seems

¹ pp. 623–626.

probable that the kinæsthetic centre was excited directly from the visual verbal centre. The patients were probably articulo-moteurs in whom the motor memory-centre had become functionally weakened. The affection could scarcely have been one of the auditory centre, for under such circumstances the patients should have had less difficulty in repeating spoken language. It is possible, too, that the peculiar symptoms may have been due to an interruption in the audito-kinæsthetic association-tract.¹ So long as the visuo-kinæsthetic tract remained uninjured, the patients might be able to speak when assisted by visual associations even though they were unable to speak spontaneously.

INTERJECTIONAL SPEECH

Under strong emotional excitement aphasic patients often give expression to words or phrases of an interjectional nature.² This sometimes occurs even when the patient is otherwise completely mute. Ballet³ cites the case of a distinguished lady whose sole vocabulary consisted in the expression *Sacré nom de*

¹ In naming association-tracts, the centre is given first from which the stimulus is supposed to emanate. Thus, activity flows from the auditory to the kinæsthetic centre through the *audito-kinæsthetic* tract. It flows in the reverse direction through the *kinæsthetic-auditory* tract.

² See p. 124.

³ "Le langage intérieur et l'aphasie," 2d ed., pp. 119-120.

Dieu! He states also that the speech of the poet Baudelaire was limited to the expletive *Cré nom! cré nom!* Numerous cases of like nature are on record.

The explanation for this exclamatory speech may be found in the greater intensity of the emotional stimulus. Just as several normal stimuli acting concurrently may produce a response in torpid cells, so a single stimulus may produce a response if its intensity equals that of the sum of the several stimuli.

It has been suggested that familiar and emotional expressions ("degraded" speech) are represented in the right hemisphere of the brain. The assumption is rather gratuitous; and the fact that it disposes of a few difficulties is not sufficient warrant for its acceptance. It seems more reasonable to suppose that the different mental images are represented in the cortex by a plurality of cells, and that some of the cells escape damage. If a few of these undamaged cells were strongly excited, the effect would be the same as though a greater number of cells were excited to a less degree.

It is manifest that a mental image becomes more deeply ingrained through the repetition of a sensation. Even when there are extensive organic lesions in the cerebral centres, the memory of more familiar experiences frequently endures. An aphasic patient may be practically mute, and yet be able to give expression to such familiar words as *yes* and *no*. Often an agraphic

patient can write his own signature, and often a word-blind patient can read his own name. Frequently the amnesic polyglot patient loses his memory for one or more languages, while the memory for his mother-tongue remains unimpaired. One cannot for a moment suppose that the destructive processes of disease respect the conscious content of a cell, — that the cell presiding over *no* is less liable to destruction than the cell presiding over the word *negative*. But, since the more familiar expression is less readily forgotten, the only alternative is to suppose that it is more extensively represented in the cortex. If this is the case, there can be no doubt that repetition brings new cells into activity.

When a lesion is inflicted upon one of the centres in the memory-hemisphere of the brain, the function of the centre is in some instances vicariously assumed by the corresponding centre of the uninjured hemisphere. This is most likely to occur in early childhood, but with persistent education it appears to occur in some instances in later life. The transference of function is, of course, effected by reëducating the patient. The word-concepts are not bodily transferred to the uninjured hemisphere of the brain; they have to be organized afresh through the reëstablishment of associations. If the auditory centre in the left hemisphere happens to be injured, the cells in the right

hemisphere must become active before the auditory memory can be reestablished. But, for the auditory images to possess associations of meaning, it is evident that these new auditory cells must be in physiological connection with memory-cells in other centres of the brain. These centres are probably not transferred from the old hemisphere. They are connected with the new hemisphere by transverse fibres; hence the organic association may be transverse. It is quite clear that the new associations can be established only by associations in actual experience, — and this, too, even when the memory-cells of the undamaged centres are not replaced by new ones. Thus the patient has practically to be educated anew. The process of re-education is a slow and laborious one. Except in the case of the very young child, the transference of function hardly ever takes place spontaneously.

The question may suggest itself as to whether it would not be desirable for one to strengthen the weaker image-types lest the more dependable images should at some time become impaired. It is doubtful, however, whether the mental images *can* be developed to any great extent. Some psychologists have asserted that the weaker images can be developed by more frequent use and by the multiplication of associations, but the matter is really open to question. The subject will be discussed later in another connection. But,

assuming for the time that mental images can be developed, it is certain that the limit of development would be low for a type of imagery that does not freely and spontaneously assert itself. On the contrary, the limit of development would be high for the type of imagery that predominates in one's thinking. Nevertheless, a limited development of the rudimentary imagery might be considered more desirable than no development at all. The trouble, however, is this: One does not possess the ability and intelligence to direct one's thinking during that period of life when the mind is in the plastic state. By the time the necessary ability and intelligence are acquired, the mental characteristics are practically established; and though it may be possible to strengthen the weaker imagery to a limited extent, the salient mental traits will be unalterable.

Whatever may be the degree to which mental images can be developed, it is certain that it would be of little benefit for one to strengthen the weaker images merely as a safeguarding measure in case of deprivation of the more dependable faculties. Cerebral lesions are of rare occurrence, and a person suffering such injuries is usually unequivocally *hors de combat*. When the lesion is not fatal to life or intellect, there occurs spontaneous development of those faculties that remain unimpaired, and they then reach a degree of efficiency that would formerly have been unattain-

able. Considering the other side of the question: should some misadventure result in the obliteration of a carefully strengthened type of imagery, then the ensuing loss would be far more disastrous than would have been the case if the imagery had remained undeveloped. However, cerebral lesions are too infrequent to warrant the adoption of psychological prophylactic measures; and any development of imagery that may be possible will be resorted to for utilitarian purposes and not as a safeguarding measure against an unlikely *contretemps*.

CAUSES OF APHASIA

The causes of aphasia are somewhat arbitrarily differentiated as *functional* and *organic*. In reality there is no such division, for functional defects are in themselves due to organic causes; though the abnormal organic conditions may not be visible to the naked eye. Strictly speaking, even chemical changes are organic. The classification of defects as functional and organic is one only of convenience.

Among the most obvious of the organic causes of aphasia is laceration of the cerebral tissue. This is usually due to penetration of the skull by some foreign body. A splinter of bone may itself press upon the brain or may lacerate the cortex. This sometimes happens when the cranium is struck by a dull body, — as the result of a fall, for instance. Sometimes aphasia occurs from these causes when there is no fracture of

the skull. In such cases there is laceration of the finer cerebral fibres, or the disturbance is induced indirectly by the mental shock.¹ Further organic causes are cerebral tumors or abscesses, inflammation of the brain, softening of the brain (often due to obstruction of the cerebral blood-vessels), rupture of the cerebral vessels, tuberculosis of the meninges, etc.

Among the so-called functional causes of aphasia are temporary obstruction of the cerebral vessels, spasm of the vessels, etc. Cerebral congestion may likewise induce aphasia. Aphasia is often due to nervous exhaustion following overwork, mental fatigue, worry, etc. Another frequent cause is a toxic condition of the blood — due to lead or copper poisoning, poisoning by stramonium, belladonna, etc. A toxic condition may likewise be caused by snake-bites, acute alcoholism, bromide intoxication, excessive tobacco-smoking, and — when the poison is engendered within the system — by diabetes, gout, Bright's disease, typhoid fever, smallpox, measles, etc. In general, it may be said that aphasia can be induced by any cause that brings about an abnormal condition in the cerebrum.

¹ See p. 226.

CHAPTER VII

STAMMERING

WE come now to the consideration of stammering.¹ Our first task will be to ascertain the cause of this speech-defect. For convenience, we shall consider first the theory of its cause that finds at the present time the widest acceptance among pathologists. This theory supposes that stammering is due to a delay in vocalization; in other words, to the stammerer's inability to produce voice.² The theory was first promulgated by Dr. Neil Arnott, in 1827, in his

¹ The word *stammering* is used in this work generically unless an antithesis between stuttering and stammering is expressed.

It will be seen later that the distinction between stammering and stuttering is an artificial one. *Stuttering* is usually defined as a form of defective speech manifesting itself in repetition of the initial consonant. *Stammering* is defined as a form of a defective utterance characterized by strangulatory and compressive effort — or as any minor form of speech-hesitation that is not stuttering. Much confusion has arisen in these definitions through English and American authors translating the German word *stammeln* (*lalling* or *baby talk* in its milder forms) as *stammering*.

² The pathologist regards this phenomenon more as the form in which stammering manifests itself. The "inability to vocalize" is represented as the *cause* rather by ignorant quacks, who guard this as one of the secrets of their profession.

"Elements of Physics." Later the theory was supported by Merkel in Germany.¹ Merkel no doubt advanced the theory independently, as many other writers have done since the time of Arnott.

Wyllie expresses the theory as follows:²

"In the common variety of stammering the speaker neglects the laryngeal mechanism; and, when no speech is emitted, he unwittingly throws increased force into the wrong quarter, viz., the oral mechanism, whose nerve centres thus become surcharged with energy, which may overflow into other centres and produce spasmodic complications. . . .

"That the defect of speech in the common variety of stammering is due to Delayed Action of the laryngeal or vocal mechanism in attacking the first syllables of words, is an old proposition; and is also to the present day maintained by the best writers on the subject."

Bastian holds the same view concerning the cause of stammering:³

"Stammering is a hesitating, spasmodic speech defect often beginning about the fourth or fifth year, and much more common in boys than girls, which is due not so much to a want of precision or coördination in the action of the several groups of muscular elements constituting the oral articulatory mechanism, but rather to a want of accord between the action of the laryngeal and the oral speech mechanisms. There is mostly a lagging action of the former."

¹ "Schmidts Enzyklopädie der ges. Medezin," Bd. VI, 1844.

² "Disorders of Speech," pp. 2-3.

³ "Aphasia and Other Speech Defects," p. 58.

It is easy enough to show that the difficulty of the stammerer is in some way connected with the production of the vowel, and that the consonant is not the obstacle, as would appear to the casual observer. The arguments in support of this proposition are as follows:

a. When the stammerer falters on a continuous consonant, he usually prolongs the consonant for several seconds. He stammers on the word *six*, let us say, and produces the *s* continuously. Now, the fact that he is producing the *s* shows clearly that he has no difficulty in articulating the consonant. His difficulty is to produce the vowel; and as soon as the vowel is uttered, the sibilation stops. In a monosyllabic word that has no final consonant — the word *so*, for example — the word is complete as soon as the vowel is enunciated. The same arguments apply in every case of continuous stammering. The difficulty is not with the consonant, since this is usually produced to excess. The consonant is prolonged only because the vowel is delayed.

b. In *stuttering*, the consonant is produced repeatedly. The speaker attempts to say *ten*; but he produces a series of *t*'s and the word becomes *t-t-t-ten*. Since the *t* is repeatedly articulated, the difficulty cannot lie with the consonant. The *t* is repeated only because the succeeding vowel refuses to appear. (Unlike the letter *s*, the *t* cannot be produced con-

tinuously; hence it is repeated when the vowel is delayed.) The same argument applies in every case of stuttering upon explosive consonants. The consonant is repeated; hence there is no obstruction to its articulation. The repetition is occasioned only by the delay in the appearance of the vowel.

c. If the stammerer's difficulty lay with the articulation of the consonant, he would stammer quite as much at the end of a word as he does at the beginning. The stammerer, however, never hesitates at the end of a word :

"No stammerer has ever faltered in attaching the consonant to the vowel in such syllables as *ad*, *ek*, *ik*, *ob*, for the reason that it is quite impossible for him to do so."¹

d. That the difficulty does not lie with the consonant, but with the vowel, is borne out by the fact that stoppage often occurs when the word *begins* with a vowel. The stammerer may find the word *any* as difficult as *many*, and *angle* as difficult as *dangle*. When he stammers on the initial vowel, there can be no question concerning difficulty with consonants. Often there is no consonant at all in the word, and the difficulty appears with such words as *I* and *a*.

e. The stammerer rarely has difficulty in singing. But song differs from speech chiefly in the manner in which the vowels are produced; while there is mani-

¹ Merkel, "Anthropophonik," p. 908. (Quoted by Denhardt, "Das Stottern eine Psychose," p. 28.)

festly no radical change in the consonants. The absence of the stammerer's impediment in song indicates, then, that the vowels occasion the difficulty in speech.

From these arguments it is evident that the stammerer's trouble is due to the delay of the vowel. Hence the theory arises that the stammerer is unable to produce voice, — that his difficulty is due to a lagging of the laryngeal action.

Unfortunately this theory does not take account of all the facts, and the facts that it disregards are sufficient to refute it. If the stammerer's impediment were due solely to his inability to produce voice, then all trace of the impediment should vanish as soon as he begins to whisper, for in whispering no phonation occurs. But actual experience shows that the impediment persists in approximately two cases out of three (Hermann Gutzmann).¹ This is conclusive evidence that the difficulty does not lie with the production of *voice*, as such.

A second fact shows just as conclusively that the difficulty is not one of vocalization. One often stammers on continuous sonant consonants, and in this case there is continuous production of voice. In endeavoring to pronounce the word *many*, the stammerer may produce the *m* as a continuous humming sound. Here

¹ Kussmaul, "Störungen der Sprache," 4th ed., p. 352.

there is certainly no delay in the action of the larynx.

Still another fact bears witness that the stammerer's difficulty is not one of phonation. The stammerer often vocalizes when stammering or stuttering upon a vowel. One writer says, when speaking of repetitive utterance:¹

"It is by no means uncommon for a stammerer to go through the same process of repetition when trying to pronounce a word commencing with a vowel."

Kreutzer, in endeavoring to defend the thesis that stammering is a "refusal of the voice," writes as follows:²

"If the answer is made that frequently a stutterer repeats a vowel, as E-E-E-E-E in *Emil*, A-A-A-A-A in *Adolf*, etc., and that therefore I cannot say that the 'E' and the 'A' are the obstacles, I must still maintain my ground, for a closer examination soon reveals that all the stutterer vocalizes is only a part of the 'E' and the 'A,' and that the vowels are never perfectly formed."

These facts clearly show that the stammerer's difficulty is not one of phonation. But they show further that his difficulty is in some way connected with the production of the vowel. When the stam-

¹ Mrs. Emil Behnke, "On Stammering, Cleft-Palate Speech, Lisp-ing," p. 10.

² "Kreutzer's Method" (*The Voice*, 1881, Vol. III, p. 175).

merer hesitates while whispering, he produces the initial consonant repeatedly or continuously, and is unable to pass to the vowel, — or he may hesitate on a vowel if it begins a word. When, in speaking aloud, the stammerer falters on a continuous sonant consonant, he produces the consonant as continuous voice, but is unable to pass to the vowel. When he vocalizes, but does not complete, an initial vowel, the difficulty is in some way connected with the vowel itself.

Now, since the stammerer's difficulty *is* to produce the vowel, and is not to produce *voice* per se, it is evident that his difficulty must be to produce the *vowel-color* or *vowel-quality*. *The stammerer's difficulty is transient auditory amnesia*: he is unable to recall the sound-image of the vowel that he wishes to enunciate. This, then, is the thesis of the present monograph.

The stammerer is an audito-moteur. He relies for his speech-cues upon both kinæsthetic and auditory images. When he stammers in enunciating a word, it is because there is complete failure of the auditory image. His futile struggles with the initial consonant are directed solely by his kinæsthetic imagery, but he cannot pass to the vowel because he cannot recall its sound, its peculiar or characteristic quality, — in short, the *vowel-color*. When he attempts to speak the word *ten*, he produces the *t* entirely by feeling; but he cannot mentally hear the sound *ě*, and is hence

unable to proceed. His mental imagery might be diagrammed as follows — *T-N*; with the capitals representing kinæsthetic images of articulatory movements, and the hyphen representing a mental hiatus. It would be more accurate to represent the mental image as *T-*, simply; the consonant representing a kinæsthetic image, and the hyphen representing an auditory blank. The kinæsthetic image of the *N* does not appear during the stammerer's futile efforts to articulate. The diagram *T-N* represents, however, the verbal image as it occasionally appears *in silent thought*.

The assumption is not made in regard to the stammerer's normal verbal imagery, that he has an auditory image only of the color of the vowel. Many stammerers may have an auditory image of the entire word, but so long as the image fails to appear during speech, stammering must inevitably result. The stammerer's kinæsthetic image of the initial articulatory movements would permit him to struggle with the word, but till the auditory image arose in his mind he could not complete it. It is, however, primarily the failure of the auditory *vowel*-image that occasions the stammerer's difficulty, for the auditory impression of the consonant is generally supplied by the actual stammering.

The theory that stammering is occasioned by the speaker's inability to recall the auditory image of the

vowel-color¹ is borne out by practically every manifestation of the defect and every phenomenon connected with it.

In the simplest form of stammering there occurs merely a pause between the consonant and the vowel; the pause, of course, being occasioned by the speaker's inability to reintegrate the necessary auditory image. Kussmaul says of this form of stammering:²

"There are slighter forms of the impediment in which the defect manifests itself only in undue prolongation of the consonants *g, k, w*, etc. In our younger days we were more amused than was seemly at the speech of an old nurse, who spoke somewhat as follows: 'K-h-ommen Sie endlich? Der K-h-affee ist schon etw-h-as k-h-alt.'"

The defect, it will be seen, is not a prolongation of the initial consonant, but simply a delay in the appearance of the vowel. The defect differs from ordinary stuttering or stammering only in the fact that the initial consonant is not repeated (stuttering) when the vowel-image fails to appear, and that there is no attempt to force the utterance of the word by undue pressure upon the consonant (stammering).³

In severe cases of stammering it quite frequently

¹ It will be seen later that auditory amnesia is not the primary cause of stammering when the disturbance has been induced by imitation.

² "Störungen der Sprache," 4th ed., pp. 246-247.

³ In stammering, the articulative effort is, of course, occasioned by the inordinate expression of the kinæsthetic image. The stam-

happens that the speaker, after fearful struggle with a word, gives utterance to an entirely inappropriate vowel. This fact shows that the conditions affecting the vowel-image are abnormal. Through defective internal audition the wrong auditory vowel-image is invoked, or no auditory image is invoked and the vowel is produced kinæsthetically. Kussmaul has remarked this mutilation of sounds in syllable-stumbling and "stammeln" — forms of speech-defects that sometimes coexist with stammering:¹

"With the syllable-stumbler as well as the 'stammer,' one sees quite frequently an interchange of related sounds; *i* and *u*, *u* and *e*, *oe* and *e*, *u* and *o*, hard and soft consonants, etc. Or the preceding or succeeding consonant leads to the use of the wrong vowel in the middle of the word because the correct vowel involved a too difficult transition."²

Hunt also refers to the occurrence of this phenomenon in cases of stammering:³

"Let us take a simple case: when the stutterer cannot produce a vowel sound, — a vowel stutterer. In this case two actions are requisite; first, the air must be expelled from the

merer finds himself checked at the consonant when the auditory image fails to appear. He struggles with the consonant largely through ignorance of the conditions.

¹ Kussmaul considers the cause of stammering to be "a congenital irritability or weakness of the syllable coördinating apparatus" (*loc. cit.*, p. 247).

² Kussmaul, *loc. cit.*, pp. 220-221.

³ "Stammering and Stuttering," 7th ed., p. 239.

lungs; next, the vocal cords in the larynx must be in a position to vibrate. The difficulty in this case is caused by the inability to associate the action of the muscles of expiration with that of the vocal cords. . . . To take a more complicated case: The stutterer can produce the sound, but cannot articulate it so as to form the desired vowel. Here the lungs act normally, but the disharmony lies in the coördination of the action of the vocal with the articulating apparatus. For instance, take the word *how*. His lungs being supposed to act normally, he sounds the aspirate *h* and a part of the vowel. Here we must observe that the sound *ow* in the above word is a compound sound — *au* and *oo*.¹ He produces the sound *au*, but fails in conjoining it with the succeeding sound *oo*. This requires the retraction of the tongue and the protrusion of the lips. The same difficulty of coördination is visible here. A stutterer of this kind, unless his respiration is at fault, in which case no sound can be produced, finds no difficulty in producing the pure vowel sound, neither has he any difficulty in the movements of the lips and tongue when not speaking; but when these are required to be associated for the formation of speech-sounds, he hesitates and stutters.”

On another page the same writer says, after referring to another form of stammering:²

“In others, again, the vowel can be formed in the larynx, but the stutterer is unable to complete its formation, or conjoin it with a consonant, by the intervention of the articulating organs. This is especially the case with the sounds *i*, *a* (*ay*), *ow*, etc.”

¹ The elements of the diphthong *ow* can be more accurately represented as *ah-oo* (as in *far* and *who*), or in Bell's *Visible Speech* symbols as J̣ or J̣̣. — C. S. B.

² Hunt, *loc. cit.*, p. 246.

Ssikorski likewise describes the distortion of the vowel, — and, like Hunt, has a physiological explanation for it :¹

“For example, the vowel *u* sometimes sounds more like *o* — this because the lips were not rounded and protruded to the position for *u* when the spasm² appeared, but were merely moving toward this position. The same phenomenon may be observed in the production of other sounds as well.”

Beesel, Colombat, and other writers also describe this imperfect production of the vowel.

When an inappropriate vowel replaces the correct one, there is either a wrong auditory image in the mind, or there is no auditory image and the vowel is produced kinæsthetically. When a diphthongal vowel is only partially produced, there is either failure of part of the auditory vowel-image, or — what is more likely — there is failure of the whole image, and part of the vowel is motorially initiated. As a rule, the part of the vowel that is produced is entirely incorrect.

Another striking phenomenon shows conclusively that the stammerer's difficulty lies with the auditory vowel-image. Often stammering occurs *only* when particular vowels appear in the word. The nature of the initial consonant then has little effect upon speech. This fact has been noted by Denhardt :³

¹ Ssikorski, “Ueber das Stottern” (from the Russian), p. 75.

² These spasms will be discussed later (pp. 263 ff.).

³ Rudolph Denhardt, “Das Stottern eine Psychose,” p. 31.

"Sometimes one meets stammerers for whom particular consonants are difficult only when they occur in conjunction with particular vowels. Thus, *ko*, *ku*, and *tu* may be difficult; but not *ka* and *ta*."

Stekel reports a case of this kind:¹

"The third case that I had occasion to handle concerns a gentleman that was unable to pronounce words containing the vowel *a*. Words in which the *a* occurred twice were especially difficult. It cost him a great deal of effort to pronounce such a word as *cataract*, and it was extremely painful for him to employ such words in conversation. At a social affair he once mispronounced the word *papa* as *popo*."

It will be noticed that in this case there was difficulty with particular vowels, and sometimes mutilation of the vowels when they were finally pronounced.

As a rule, particular vowels are difficult only because their auditory images are more difficult to recall. The most difficult vowels for the stammerer to re-integrate are those that are least definite and tangible in their coloration. For this reason stammering occurs with far greater frequency on the short vowels than it does on the long vowels.² The stammerer is less likely to have trouble with the word *light* than with the word *lit*. This is because the long vowel *i* is clearer and more tangible than the short vowel *ɪ*.

¹ "Nervöse Angstzustände und ihre Behandlung," p. 233

² Pitman gives the long vowels as *ah*, *ā*, *ē*, *aw*, *ō*, *ōō* (*pa*, *may*, *we*, *all*, *go*, *too*), and the short vowels as *ă*, *ĕ*, *ĭ*, *ŏ*, *ü*, *ŏŏ* (*that*, *pen*, *is*, *not*, *much*, *good*).

The auditory image of the former vowel is more readily reintegrated. It is, as it were, more definite and substantial, and the mind can better recall it. An analogy may be drawn between vowel-color and color as it actually appeals to vision. The long vowel in *light* might be compared to a vivid and definite green, and the short vowel in *lit* to an intangible and indefinite gray. The vowel in *bate* might be characterized as red, and the vowel in *bat* as indefinitely brown. The long vowels are found to have more definite color as they fall upon the ear, and the distinction is even more marked as they are recalled in auditory imagery. The long vowel may be mentally heard with considerable clearness when the short vowel absolutely refuses to rise in consciousness. When this vowel-sound fails to appear, the stammerer can no more pronounce it than the musician can tune an instrument from a key-note that he has not heard.

As already stated, the short vowels fail more frequently than the long vowels; hence they afford the stammerer greater difficulty. This fact has been recognized by a number of writers. Dr. Findley says:¹

"Syllables with a short vowel are much more difficult to utter than those with a long or broad sound; thus it is much easier to say *bate, beat, bite, danger*, than to say *bat, bet, bit, death*. In the case of uttering the different consonants, there is no uniformity, some being more difficult to one, others to another,

¹ *The Voice*, April, 1885 (article, "Stammering").

generally the mutes give more trouble than the semivocals. In this respect the experience of the same person is not uniform."

Itard, who wrote nearly a hundred years ago, says of the matter:¹

"A good deal also depends on the vowel with which the consonant is combined; thus stammerers find less difficulty in articulating *co* than *ca*."

In 1830, Hervez de Chégoin wrote as follows:²

"It is possible to convert the difficult word *baliveau* into a very easy one without changing the consonants *b*, *l*, and *v*, but by changing the vowels that follow *b* and *v*. To illustrate, *bé* replaces *ba*, *li* remains unchanged, and *vier* takes the place of *veau*. The word thus becomes *bélivier*, a word that would cause me no difficulty, though I hesitate on the word *baliveau*."

It will be noticed that in this case the short and intangible vowels have given place to others of a more definite coloration.

Wyneken says in regard to long and short vowels:³

"I may remark that according to my own experience these consonants are especially difficult when combined with a short vowel or diphthong (*au*, *ai*, *eu*). Most stammerers find the words *Bann*, *Pappel*, and *Kamm* more difficult than *Bahn*, *Papel*, and *Kam*. And even at the beginning of a word the short vowels and diphthongs occasion stammering more frequently

¹ "Mémoire sur le bégaiement" (*Journ. universel des sciences médicales*, 1817).

² "Recherches sur les causes et le traitement du bégaiement," p. 8.

³ "Ueber das Stottern und dessen Heilung," p. 6.

than the long vowels. Thus the words *Otto* and *Ammen* are more difficult than the words *Otho* and *Amen*.”¹

Statements similar to those quoted above are made by most writers on the subject of stammering.

It is interesting to note that the stammerer, when employing synonyms for difficult words, usually replaces a short vowel by a long one. It often happens that the initial consonant is retained; so it is quite evident that the consonant itself presents no difficulty. Thus the stammerer says *saneness* instead of *sanity*; *gamester* instead of *gambler*; *dine* instead of *take dinner*; etc. In these cases there is a change from a short to a long vowel, though the initial consonant remains unaltered. The change is made from the short vowel to the long one because the long vowel has a more distinct coloration, and hence can be more readily recalled.

There is another striking phenomenon that shows clearly the relation between stammering and auditory amnesia. The stammerer can almost invariably articulate a word as soon as some one pronounces it for him. The explanation is, of course, that the acoustic impression supplies the refractory auditory

¹ The writer can scarcely agree with Wyneken that *diphthongs* occasion stammering more frequently than the long vowels — though they frequently occasion a more conspicuous form of stammering for the reason that the speaker can commence them but cannot finish. Many of the long vowels are themselves diphthongs, but the short vowels are invariably monophthongal.

image from without, and that the stammerer need not then struggle to arouse the image in his mind. After he has heard the word that he was trying to enunciate, he is able to pronounce it while the primary acoustic image remains clear. As soon as this primary memory fades, he stammers on the word as before.

The ability of the stammerer to repeat has been noted by practically every writer on the subject of stammering. Kussmaul says:¹

"The impediment ceases as soon as some one pronounces the refractory word by way of assistance."

Dr. Rafael Coën makes the following observation:²

"I spoke the word after the stutterer, and immediately he could say it without the least hesitation. This is a fact that I have observed in all stutterers [stammerers] and which enables me to distinguish stuttering [stammering] from kindred speech-affections."

And thus Denhardt:³

"As a rule, the stammerer can repeat without hesitation a word that he hears pronounced. One observes this very frequently when he pronounces the word for the stammerer in order to put an end to his painful struggles. One pronounces the difficult word himself, expecting the stammerer then to proceed. But before continuing his conversation the stammerer almost invariably articulates the refractory word, — and this too without the slightest difficulty; although only a moment

¹ "Störungen der Sprache," 4th ed., p. 244.

² *The Voice*, Vol. VII, p. 22 (article, "Stuttering").

³ "Das Stottern eine Psychose," p. 51.

before, the word seemed checked by insuperable obstacles. As a rule, the spasm is suspended the very moment the stammerer hears the recalcitrant word from the lips of his companion, and it gives place at once to the appropriate and thoroughly normal conformation of the speech-organs."

This ability of the stammerer to repeat is attributed by Denhardt to the reassurance the speaker derives from the knowledge that he is already understood. Kussmaul offers a similar explanation. Undoubtedly the reassurance mitigates the stammerer's difficulty; but this is not the chief reason for his fluency, for he frequently stammers when he knows that he is understood, and he stammers sometimes when he is alone. The real explanation is that the auditory impression furnishes the mental image that was not previously forthcoming. When the auditory impression is supplied, the stammerer speaks with fluency whether his words are anticipated or not. The following remark by Wyneken bears out this statement, and the reader will agree that it is replete with significance:¹

"I knew a schoolboy that was unable to recite his lesson unless a companion near-by first pronounced the words quietly for him."

It is self-evident that the difficulty in a case of this kind must be auditory amnesia.

It will be remembered that in the preceding chapter (pp. 166 ff. and 172-173) several instances were cited

¹ "Ueber das Stottern und dessen Heilung," p. 19.

in which patients suffering from auditory amnesia were able to *repeat* words without the slightest difficulty even when their speech-disturbances were so severe that they could utter very few words spontaneously. Stammering is a form of auditory amnesia; thus it is not surprising that it should exhibit this same phenomenon.

Ball records a case¹ that shows clearly the effect of auditory amnesia. The patient developed the disturbance after exposure to cold. There was complete aphasia for several weeks, but gradually the patient began to reacquire command of language. "He had partial word-deafness from the commencement; and later on he said, 'The words I can't pronounce are the words I can't hear.'" At the necropsy a lesion was found covering the inferior parietal lobule and the posterior part of the first temporal convolution. It is evident from the location of the lesion that the auditory word-centre was affected. The patient was unable to understand particular words because the auditory cells subserving them were impaired. But on account of this impairment he could not invoke the auditory images, and hence was unable to pronounce the words in question. This phenomenon precisely illustrates the amnesic condition that occasions stammering; though in stammering, the amnesia is transitory and word-deafness is little in

¹ Quoted by Bastian, "Aphasia and Other Speech Defects," pp. 327 f.

evidence. The stammerer's difficulty is less severe because the cerebral disturbance is usually functional rather than organic.

The ability of the stammerer to repeat words that are pronounced for him finds its parallel in his ability to repeat a word that he finally succeeds in uttering for himself. When the auditory image is at last reintegrated, the stammerer pronounces the desired word, the sound of the word comes back through the ear, and the auditory image is strengthened. The result is that the stammerer can repeat the word indefinitely, so long as he does not allow the auditory image to fade into its former obscurity. The immunity with the particular word is only transient, and when the primary auditory image has disappeared, the stammerer finds the word as difficult as ever.¹

The stammerer can usually read or speak aloud in unison with other people. This is another fact that has been noted by most writers on the subject of

¹ A peculiar fact should be noted at this point. When the stammerer has not been understood and is requested to repeat a word, he cannot always do so. The reason for this is twofold. In the first place, the auditory impression from the word is not definite and clear. If the word had been clearly pronounced, it would have been understood by the person listening. If the word is not clearly enunciated, it is evident that the auditory image cannot be greatly strengthened by the aural sensation. The second reason for the stammerer's inability to repeat is that he is seized with mental confusion and fear. The effect of these last two factors will be better understood after the perusal of succeeding chapters.

stammering. Hunt quotes one of his correspondents to the following effect :¹

"In private and alone I can read and speak without stuttering at all; and not only so, but in church can join in all of the responses of the congregation without hesitation, my voice being borne along as it were by theirs; for if their voices suddenly were silenced, I should become perfectly speechless."

The explanation for the stammerer's fluency under such conditions is that he is supplied with the auditory impressions of the words by those around him — the case being somewhat analogous to the stammerer's repeating words spoken by another person.² He derives the same assistance from the auditory impressions that the musically amnesic patient derives from an accompaniment.

Wallaschek³ cites the case of the opera singer, Emil Scaria, who was suffering from some incipient cerebral disturbance. The patient was affected by amusia, and found himself unable to recall the notes he had to sing. He therefore requested the manager that some one be allowed to accompany him upon the stage and sing the notes quietly with him, as he could not otherwise remember the music. There seems to

¹ "Stammering and Stuttering," 7th ed., p. 272.

² Undoubtedly the stammerer is also assisted by the fact that general auditory impressions tend to facilitate the arousal of the sound-images. (See pp. 347 ff.)

³ "Die Bedeutung der Aphasie für die Musik-vorstellung" (*Zeitschrift für Psychologie*, Vol. VI, p. 9).

have been no aphasia; the patient's difficulty lay apparently only with the pitch. Musical amnesia of this kind is quite common even when no cerebral defects are present. It is recognized as the lack of a "musical ear." Often the person cannot keep in tune when he sings by himself, but has no difficulty if some one sings with him or whistles or plays the melody for him. The person with musical amnesia cannot recall the appropriate pitch, but he proceeds without difficulty as soon as the pitch is supplied by the auditory impressions from without. With the stammerer it is not the pitch, but the vowel-color, that is difficult of recall; and as soon as this is supplied, the stammerer speaks with perfect fluency.

Another fact showing the relation between stammering and auditory aphasia, and showing the effect of tangibility of the auditory image, is that the stammerer can almost invariably *sing* without difficulty. In the preceding chapter (pp. 156-160) several instances were cited in which aphasic patients could sing quite readily, although they had practically no command of voluntary speech. Thus it is not surprising that the stammerer should sing without evincing the impediment.

The stammerer's ability to sing could be most easily explained on the supposition that disparate brain-centres preside over the auditory memories for speech and music. It is practically certain that

the anterior part of the first temporal convolution presides over the musical memory, but it is not entirely certain that this centre presides over vocal music. It is possible that it may store up the memory merely of instrumental music or the memory for pitch; hence it is desirable to find an alternative explanation that does not premise the existence of discrete auditory centres for speech and vocal music.

The ability of the stammerer (and sometimes of the aphasic patient) to sing is readily explained by the greater tangibility of the auditory image in singing. As the long vowel is more tangible than the short vowel, so the musical tone is more tangible than either. The auditory impressions derived from singing the words "It was the New Jerusalem" to their accustomed melody are infinitely more definite and substantial than the auditory impressions derived from speaking the words in a conversational tone at conversational speed. The words, when sung, are more likely to remain in memory in auditory terms. The kinæsthetic images, it should be noted, are practically identical in speech and song. It is the auditory images alone that differ. In song, the auditory nucleus is more substantial.

The musical memory *must* subsist largely in auditory terms, for it is almost exclusively a memory of pitch. When a note is sung, it maintains the same absolute pitch through its entire duration, and this pitch is

retained in memory. In speech there is inflection, and the pitch changes even during the enunciation of a single syllable. The pitch, then, is the principal element in song, and vowel-color is purely secondary. As a rule, the vowel-color is sacrificed by the singer, and the auditor is quite unable to tell what words are being sung. This surrender of vowel-color is another reason for the stammerer's ability to sing, for his difficulty lies with the vowel-color and not with the pitch. Even if the vowel-color were accurately rendered in singing, one could readily explain its greater intensity in auditory memory by the fact that the vowel has a greater duration. In speech, the stammerer has less difficulty with the so-called short vowels that have a relatively long duration¹ than he has with those that are actually accorded a staccato utterance.

It should be noted that the stammerer cannot sing songs of every kind without difficulty. A "patter" song, by reason of its rapid movement, often causes as much difficulty as speech. The notes are of short duration, and the singing approximates ordinary speech. It is only when the notes are actually

¹ The short vowels as well as the long vowels can, of course, be prolonged till the breath is exhausted. The designation *short* and *long* is rather inapt. The difference is one of color rather than of length, for even in speech the "short" vowels often possess a relatively long duration.

lengthened, and vowel-color gives precedence to pitch, that the stammerer's difficulty in singing vanishes.

To summarize these arguments: The stammerer's ability to sing is accounted for by the greater subjective tangibility of the general auditory impression, and the consequent greater tangibility of the auditory image. Fluency in singing is further explained by the fact that, in song, pitch is preëminent, while vowel-colors are subordinated.

These facts present the psychological reasons for the stammerer's ability to sing. They do not necessarily presuppose that singing is a special faculty subserved by a special brain-centre. But whatever may be the facts in regard to special localization, and whatever the subjective facts concerned, the mere ability of the stammerer to sing supplies a potent argument in support of the thesis that stammering is a form of auditory aphasia.

It is possible to adduce a physiological reason for the fact that the stammerer sings more readily than he speaks. The inflection of speech demands a far more complicated action of the vocal organs. During the rise and fall of pitch there is an increase or decrease in the tension of the vocal cords, — this change of tension requiring delicate muscular action. In singing, each single note remains at a definite pitch, and there is no change in the tension of the vocal cords till the next note is reached. This is the explanation that

is generally advanced for the stammerer's freedom from his defect in singing. There is, however, no occasion to look for physiological explanations, for the various paradoxes of stammering are certainly of psychological origin.¹

Sufficient has been said of the subjective aspect of stammering to show that it is caused by a failure of the auditory image to rise in consciousness, — in other words, that it is due to auditory amnesia. Subsequently, further evidence will be adduced in support of this thesis; but we shall now consider more directly the points of objective similarity between stammering and aphasia.

It is generally conceded by investigators that stammering is a form of aphasia, but the defect is usually

¹ There may sometimes exist a physiological disturbance in the brain, but there is no physical defect in the peripheral organs. The absence of physical defect in the organs of speech is easily demonstrated. The stammerer usually enjoys fluent speech for several years before the inception of the impediment; hence his speech-organs cannot be malformed. Furthermore, there are almost invariably certain circumstances under which the stammerer can speak with facility after the development of the impediment. He speaks without stammering in the presence of friends, or perhaps in the presence of strangers; almost invariably he speaks well when alone. He repeats with facility, and speaks well in concert with other people. He does not always stammer on the same words; and he can repeat — after he has once pronounced it — almost any word that occasions difficulty. Whenever there exists a defect in the peripheral organs, the disturbance in speech manifests itself impartially under all conditions.

classified as subcortical motor aphasia, or aphemia. Stammering has rarely been studied as an aphasic disturbance. Indeed, the objective study of stammering has in general led to negative results. The symptoms are variable, and there is usually an absence of cerebral lesion; thus the pathologist finds few clues whereon to base his classification. A few cases of stammering have been recorded in which cerebral lesions were present,¹ but these lesions have usually been sufficiently extensive to be lacking in significance. Furthermore, in such cases the stammering is a collateral disturbance, the major defect being really a form of aphemia. The patient stammers in his attempt to speak, but he stammers on all words impartially; he uses inappropriate consonants as well as vowels, and his speech is more or less an incomprehensible jargon. These cases cannot be considered as forms of true stammering, and no valid deductions can be made from them.

Stammering resembles aphasia in its mode of origin. Broadly, it may be stated that any cause that induces aphasia can also induce stammering. Most of the causes that occasion stammering can also produce aphasia. (The two causes of stammering that do not produce aphasia are association and imitation. Stammering arising from these causes is not of the

¹ See Kussmaul, "Störungen der Sprache," 4th ed., p. 161 and pp. 318 ff.

amnesic form; it will be considered in a later part of the chapter.) The causes of stammering, as given by Ssikorski,¹ are — emotional shock, traumata, infectious diseases, cachexia, convulsions (and imitation). These same causes, it will be seen, are among the most prolific causes of aphasia.

Transitory stammering frequently occurs, and its causes are similar to those inducing transitory aphasia. Some of these causes cited by Kussmaul² are — mental strain from overwork, lack of sleep, the smoking of too strong tobacco, intoxication, epileptic fits, indigestion, acute infectious diseases, etc. Temporary aphasia or stammering often occurs during febrile illnesses, disappearing as soon as the fever subsides. Stammering often occurs as the result of anæmia following severe illnesses. When the anæmia is acute, after loss of blood from injuries, for instance, complete aphasia often results.

Stammering sometimes begins *as* aphasia.

“H. Schmidt records a case in which a hussar was kicked by a horse on the left side of the forehead, and suffered as a consequence from aphasia, deafness in the left ear, and paralysis of the right arm. Gradually the aphasia disappeared and stammering took its place. After four weeks his full vocabulary returned, but the stammering persisted.”³

¹ “Ueber das Stottern,” pp. 232 ff.

² “Störungen der Sprache,” 4th ed., p. 247.

³ H. Gutzmann, “Sprachheilkunde,” 2d ed., p. 381.

Many such cases are on record in which stammering has begun as aphasia.

Stammering, like aphasia, often begins with a period of complete mutism, and is often preceded by a period of unconsciousness. Ssikorski¹ observed twenty-seven cases of stammering due to emotional shock, and six of these were introduced by mutism. The duration of the mutism varied from a few hours to six months. Four of these twenty-seven cases began with loss of consciousness.

Stammering sometimes takes the form of temporary mutism, and the defect is not necessarily stammering speech. (See p. 344; also H. Gutzmann, "Sprachheilkunde," 2d ed., p. 419.)

"There are stammerers that never stumble in speech, but that stammer, nevertheless. This sounds paradoxical, but is none the less a fact."²

Stammering varies in severity with the tone of the nervous system; the same thing is often true of aphasia. Finally, it may be said that there are all degrees of stammering, which range from a slight hesitancy in speech to an impairment of utterance that

¹ "Ueber das Stottern," p. 232.

² H. Gutzmann, "Sprachheilkunde," 2d ed., p. 408. Gutzmann believes these subjects to be breath-stammerers. It seems more probable that the subjects simply experience amnesia, and suppress the physical contortions of the average stammerer. See p. 312 for explanation of common breath-stammering.

unquestionably *is* aphasia. Speaking of severe forms of stammering, Liebmann says :¹

"The worst cases are those in which the speech-disturbance approximates a form of dumbness. I have seen stammerers that were unable to utter a word for weeks, and this, too, in surroundings so favorable as the stammerer's own home."

Speech-disturbances of such severity can scarcely be regarded as stammering: they are aphasia.

One of the strange features of stammering is that it occurs with far greater frequency in the male than in the female sex. There are four or five male stammerers to every female stammerer. The chief reason for this disproportion is probably the greater variability of the male sex; the explanation is thus primarily biological. In most respects the male shows a greater variability from the norm. Color-blindness occurs in approximately one man in every twenty, but in only one woman in two hundred. The male sex supplies both the geniuses and the idiots of the race. Mentally, females vary little, and any extreme variation from the norm is seldom witnessed. Deaf-mutism is more common among males and *so also is aphasia*. In reply to an inquiry from the writer, Dr. Wyllie says :

"My impression is that aphasia is decidedly more common in the male than in the female sex."

¹ "Stottern und Stammeln," p. 46.

Dr. Joseph Collins reports similarly :

- "Aphasia when not due to traumatism is much more common in the males than in the females, the report being that the underlying pathological condition, namely, the various forms of cerebral softening,¹ are much more common in males than in females."

When cases of aphasia due to traumata are included, the proportion of aphasia among males is still greater, for they are more exposed to physical injury.

Dr. Bastian's monograph, "Aphasia and Other Speech Defects," contains reports of one hundred and fourteen cases of aphasia. Of these cases, seventy-one occur in males and forty-three in females. The cases are, of course, selected to illustrate different principles and not to demonstrate the proportion in which aphasia occurs in the sexes. These numbers may or may not represent the true ratio that exists, but they certainly indicate that aphasia is commoner among males.

Thus stammering and aphasia resemble each other in the fact that they both occur more frequently in the male sex ; and one of the chief reasons for this we may consider to be the male's greater variability. There is perhaps another reason why females stammer less frequently, and this is that their auditory imagery

¹ "It is known that males are more subject to brain tumor than females."—M. Allen Starr, "Organic and Functional Nervous Diseases," 2d ed., p. 574.

is probably more intense. Galton has shown by statistical inquiries that visual imagery is stronger in women than in men. The auditory images are probably clearer also. Certainly girls talk at an earlier age than boys; and conversableness is, in general, greater in the female sex. These facts indicate a more intense verbal imagery. If the auditory imagery is more intense, a minor functional derangement would be less likely to obliterate or obscure it; and hence would be less likely to induce stammering. This fact itself would be sufficient to account for the less frequent occurrence of stammering among women.

Another point of resemblance between stammering and aphasia is furnished by the stammerer's occasional ability to read with fluency. This ability of the stammerer has been noted by most writers on the subject. Liebmann remarks that:¹

"Some stammerers read much more fluently than they speak."

Another writer says:²

"There are many confirmed stammerers and stutterers who read aloud without impediment."

The similar ability of some aphasic patients to read with fluency has already been observed (pp. 170-174), and the probable cause for it explained.

¹ "Vorlesungen über Sprachstörungen," 1. Heft, p. 11.

² George Vandenhoff, *Homœopathic Times*, New York, May, 1877.

The interjectional speech of the stammerer is often free from impediment.

"It is well known that when stammerers are roused by indignation, a sense of wrong, etc., they are frequently released from their infirmity, or at least the latter is considerably diminished."¹

It will be remembered that a similar fluency of speech under the influence of emotional excitement is often evinced by aphasic patients (pp. 174-175 and p. 124); hence we have another point of resemblance between stammering and aphasia.

We shall consider now a case of aphasia that bears in many points a remarkable resemblance to stammering. The speech-disturbance was more severe than that occurring in ordinary stammering, being apparently due to an organic lesion. There was mute-aphasia for several months; but when speech returned, many of the characteristic features of stammering were present. The case is recorded by Bastian:²

"W. D., aged 20, was seen by me in September, 1885, in consultation with Dr. W. A. Phillips.

"He left England in good health in October, 1884, for a temporary residence in Calcutta. After his arrival he soon commenced some light duties in a merchant's office and continued well till the beginning of the month of May, 1885. During the

¹ Hunt, "Stammering and Stuttering," 7th ed., p. 269.

² "Aphasia and Other Speech Defects," pp. 73 ff.

first three weeks of that month he suffered from a general eruption of boils. On May 25, a very hot day, he went to see a military review, and early in the evening did not feel well. It was thought he had been slightly affected by the heat; the next morning he complained of pain in the back and left side of his head. He had to leave the office about mid-day, not feeling well, and the same thing occurred on the following day. There was no actual sickness and fever, but he remained rather unwell, keeping either to his bed or sofa till June 3, when he went for a short sea voyage to Madras and back.

"He returned to Calcutta on June 21, and while at dinner on that day suddenly became very excited and boisterous, and had a convulsive attack of some kind (no details as to its nature could be ascertained). For about a week after this he was at times odd in manner, sometimes muttering to himself, at others taciturn, with occasional twitchings of the muscles about the face and shoulders. Then one day he suddenly lost his speech, though his intelligence was unaffected. He understood what was spoken or written, and could himself write freely to express his wishes or in reply to questions.

"Nine weeks after this, having been completely dumb in the interval, he was first brought to me, on September 4, 1885, and he was then in the following condition. He was perfectly intelligent, understood readily all questions that were put to him, and wrote his answers freely and without any hesitation or mistake. He could move his tongue and lips in all directions, but could not utter a sound. The tongue came out straight. During the previous ten days (since his return to this country) he had suffered a good deal from pains in the left parietal and occipital region, and on two occasions had twitchings on the left side of the face. When seen, on tapping the head over the left posterior parietal region, there seemed to be tenderness. There was no lack of symmetry or mobility

about the face. The pupils were equal, of medium size, and sensitive to light. The optic disks presented nothing distinctly unnatural. There was some paresis of both upper extremities, though this was most marked on the right side; his grip, as measured by the dynamometer, being right 35, and left 47 pounds. Some distinct tremors of the right arm were noticed while the instrument was being pressed with the left hand. The knee-jerk on the right side was distinctly exaggerated, both actually and as compared with that of the left side. There was no lack of sensibility on either side of the face, trunk, or limbs. Pulse 100, regular; no cardiac bruit.

"September 9. A small blister to the nucha having been ordered for the relief of the pains in the head, just after its removal, on September 7, the patient had a convulsive attack. He became rigid, made a guttural sound, had some slight convulsions of limbs, and remained unconscious five to ten minutes. Pulse to-day 104, regular. Tongue protruded straight, but covered with white fur on the right side, tremulous.

"September 14. Pain in head now gone; no tenderness on left side; bears tapping there without flinching. Right knee-jerk still exaggerated.

"The patient after this date went to his home in the country for six weeks, where he took six grains of iodide of potassium with three minims of liquor arsenicalis three times a day, and also a draught containing twenty grains of bromide of potassium every night.

"November 26. During the first three weeks after his return the patient had seven fits, but none since that period. The total duration of each fit with subsequent stupor was said to be thirty to ninety minutes. As far as I could learn, the attacks were bilateral, associated with rigidity of limbs, or rigidity and tremors, rather than with actual convulsions, though sometimes these supervened towards the close. No

headache now; this disappeared soon after return. No twitchings of face. Pupils equal, rather sluggish to light. No deviation of tongue or lack of symmetry about face. No tenderness to percussion anywhere over head. Knee-jerks now equal, no exaggeration on right. Can walk ten miles without fatigue. Grip much improved, but still weaker on right; right 70, left 93 pounds. Optic disks healthy. Pulse 84, regular. There was no improvement, however, in regard to speech; I tried in vain to make him utter simple sounds, even after faradisation of throat and assuring him that he would then probably be able to speak.

"December 2. Writes that yesterday he repeated to *himself* the whole of the vowel sounds, and also about twenty monosyllabic words of three letters.

"December 4. Had a fit on the 2nd whilst at the dentist's, just as he was beginning to inhale laughing gas. I tried to induce him to read to me from a 'school primer.' He sat gazing at the book for several minutes, some tremors and slight twitchings of the facial muscles occurring while the efforts were being made. At last he uttered two or three monosyllables in an explosive fashion, at first very indistinctly in a sort of loud whisper, but afterwards others more plainly and at short intervals, not in quick succession. Thus, he uttered 'cup,' 'boy,' 'hat,' 'hog,' and afterwards read more currently these words: 'Let us go to the cow.'

"December 8. In the interval he has been practising reading aloud, mostly when alone. I now made him try again to read to me, and made this note: 'He sits gazing at the book, with his hands between me and the upper part of his face; but I can see his mouth plainly. His lips move, his breathing is irregular, and he seems to be making efforts to pronounce the words he sees; but no sound comes till the expiration of four and three-quarter minutes, when he said two words in a quick,

explosive manner, followed at intervals of about a quarter of a minute by two or three more words, and so on through a page of Bell and Sons' "School Primer" composed of short monosyllabic words. Afterwards he tried to read another page more continuously. This was done rather better, but was accompanied by much working of facial muscles and apparent effort. His voice was cracked and squeaking in character.

"December 15. Previously I had never been able to get him to repeat any words after me, nor to utter any words except what he read in the book as above described; but this morning he repeated after me the following phrases: 'Good morning'; 'It is a foggy day'; 'If I go on like this, I shall soon go home.' Each of these phrases was uttered after a moment or two of delay, with facial quiverings, and then sudden commencement after the fashion of a stutterer.

"December 30. He has not spoken to any one at home, but he reads better and with less delay. Has been reading to his sister and his mother. Reads more distinctly to me also.

"January 15, 1886. Hesitates and makes abortive stuttering efforts for three seconds before he can say 'Good morning,' and finally utters it very imperfectly. When set to read from the 'School Primer' he began after one minute to read in a very weak, cracky voice. He read a page in an indistinct and very hesitating manner. Writes that he reads to himself daily, and speaks to himself when he is alone. When told to utter his own name, 'William,' he only pronounces it, after several abortive trials, in a very indistinct manner. Has no pain; sleeps well; appetite good. Grip right 77, left 77 lbs.

"February 15. He went on fairly well till February 4, though for some days previously, his sister informed me, he had not 'seemed quite himself' — in fact, from the date when his father (thinking he was so much better) gave him, in accordance with his own wishes, some work to do, in the form of

accounts and writing, in connection with his country estate. About 7.15 P.M. on February 4, he was found by his sister in a room alone and unconscious in an armchair. He had not been in this room more than about fifteen minutes when he was thus found. He remained unconscious rather over an hour, having from time to time tremors over the whole of the body, the right leg being extended, stiff, and with the toes turned inwards. The right arm was also stiff, but in a flexed condition. His face was dusky. Five days afterwards he had another slight attack, a 'sort of fainting fit.' When overtired since, some twitchings have been noticed in the right limbs. He has had no practice in reading or speaking since the fit, and has been more listless in manner. Previously he had been making some progress. He told me in writing that, after commencing the work for his father, he began to have pains in the left side of his head again, though these pains were not worse on the day of the fit, nor had he been over-fatigued on that day. He also said he had not been sleeping well for two or three nights before the fit, having a few days previously left off a bromide draught which he had hitherto been taking every night.

"I did not see him again till October 9, when he was brought to me by his mother. I learned that from early in June to the middle of August he went away alone to a village in Derbyshire, and lived at an inn there. One of his sisters then went to stay with him, and found him somewhat better. He had been at home for three weeks, and during this time has been communicating with his mother orally, not having occasion to resort to writing once. He has also been reading aloud daily.

"On examination, I entered the following particulars in my case book: He complained of no pains in his head, and has no local tenderness. Appetite good; sleeps well. Pulse 88, regular; pupils equal and fairly sensitive; face quite symmet-

rical; tongue protruded straight; grip, right 90, left 117. Knee-jerks slight, equal; no ankle clonus on either side. He reads aloud much better than he did; begins without delay, but reads with a weak, rather cracky voice, and with much apparent effort and facial contortion a page from Humphry's essay on 'Old Age,' the monosyllables of the school primer being discarded. He speaks, too, in reply to questions, though much more slowly and indistinctly than he should do. His voice is husky; he articulates with much effort and facial contortion, and after an explosive fashion, somewhat like that of a bad stutterer. He was directed to practice reading several times daily, uttering each word as distinctly as possible, and also to resume doing some work for his father in connection with his farm.

"After this I heard nothing till February 28, 1887, when I received a letter from Dr. Phillips, in which he says in reference to our patient, 'he has now quite recovered his lost faculty, and is occupied in business in London. This result was not in any way sudden, but came about slowly and by continued effort and tuition.' In short, he went on slowly but steadily improving from the time I saw him last till he was sufficiently well to enter his father's office in London."

It will be noticed that the aphasia in this case bears many remarkable points of resemblance to stammering. In fact, at the time the patient was re-acquiring command of language, the defect seems to have been stammering pure and simple. At a time when the patient had practically no command of spontaneous speech he was able to read and repeat with a fair degree of fluency. Again, the speech-disturbance began with complete dumbness, a symp-

tom that often accompanies the inception of stammering.

The patient's ability to repeat suggests that the cerebral defect was some minor disturbance in the auditory centre. It will be noticed that there was pain in the left parietal and occipital regions. Since the auditory centre lies conterminous to both these regions, it is quite likely that this centre was affected. A lowered activity of the auditory centre would entail difficulty in arousing the auditory images, and hence would induce stammering. It is stated that the patient spoke "with much effort and facial contortion, and after an explosive fashion, somewhat like that of a bad stutterer."

The patient's dumbness suggests that the cerebral disturbance originally extended into the motor region. Motor disturbances are likewise indicated by the facial twitchings and the weakness of the right arm. These conditions had practically disappeared, however, before the mutism vanished.

The most striking feature of this case was the patient's ability to speak in solitude at a time when he could not speak to other people. In a footnote appended to the report of December 8, Bastian says :

"About this time, when he told me he had been repeating the vowel sounds to himself, I said he should repeat them to some one else, and he at once wrote : 'That is the difficulty. It seems so stupid. I can do it when I am alone, but not to any one.'"

It is chiefly on account of this feature that the case has been cited. The ability to speak well in solitude is one of the characteristics of most cases of stammering. From the nature of the phenomenon it is usually supposed to be dependent upon purely psychological causes. But, as a matter of fact, there are physiological causes that probably underlie the psychological. During intellectual activity there is a great increase in the amount of blood supplied to the brain. During emotional activity the amount is even greater. When abnormal pathological conditions exist in the cerebrum, this increased blood-supply probably interferes directly with consciousness.

Mosso has made a thorough investigation of the cerebral blood-supply during intellectual activity, emotion, and sleep. The results are recorded in his monograph, "*La Paura*."¹

In one experiment he employed a delicately balanced table, on which his subjects were placed. So fine an adjustment could be secured that the table would vacillate with the subject's breathing. Mosso affirms that the head-end of the table would descend if the subject became engaged in intellectual activity, or if he even endeavored to fix his attention upon an object. If the subject fell asleep, the table had to be

¹ The excerpts quoted in this work are taken from the German translation, "*Die Furcht*." There is also an English translation, "*Fear*."

readjusted on account of the recession of blood from the brain. When the subject awoke, there was so great an afflux of blood to the brain that the head remained lowered if the balance were not reëstablished.

Mosso showed by means of his plethysmograph that the volume of the arms *diminishes* during intellectual activity. This shrinkage of the arms is due to the transference of blood from the body to the brain. The shrinkage is, of course, general throughout the body.¹ In these experiments it was found that seemingly insignificant causes — the entrance of a person into the room, for instance — at once produced a shrinkage of the arms, which the instrument automatically recorded by means of tracings.

Mosso made similar tracings from the pulsations of the heart. As one would expect, there was an acceleration of the heart correlated with the change in circulation and flow of blood to the brain. The heart beat much more violently during emotional disturbances. Further experiments showed that respiration

¹ Thus Leonard Hill in his "Cerebral Circulation" (p. 74): "An anæmia of the central nervous system excites the vaso-motor centre, and if the splanchnic vessels constrict, the blood pressure rises and more blood is driven through the brain. The same result is produced by asphyxia. We have in the vaso-motor centre a protective mechanism by which blood can be drawn at need from the abdomen and supplied to the brain. At the moment that excitement from the outside world demands cerebral response, the splanchnic area constricts and more blood is driven through the brain."

was also accelerated by emotion. The greater frequency of respiration is probably a secondary phenomenon. When the blood flows faster, more rapid breathing is required for its oxygenation.

In another experiment, performed on three subjects whose brains had been laid bare by lesions of the skull, Mosso recorded the brain-pulse directly by tracings. The investigations showed that the slightest intellectual activity was accompanied by an increase in the blood-supply to the brain. The brain actually increased in volume, and its pulsations became more vigorous. One day, while experimenting with his female subject, he noticed a sudden strengthening of the brain-pulse and an increase in the volume of the brain for which he could detect no reason. Upon questioning the subject he ascertained that she had caught sight of a skull on the top of a cupboard, and that this had induced a slight fear in her by reminding her of her illness.

Mosso made tracings of the brain-pulse during sleep. For long periods the pulse would remain regular but weak. Suddenly there would occur an increased vigor in the pulsations and a dilation of the brain, indicating, beyond doubt, the occurrence of a dream. After a few fluctuations the disturbance would subside, and the brain would shrink again to its normal condition for sleep. During these experiments, if the least noise occurred or if a light were

brought near the subject, there followed the same increased vigor of the brain-pulse. Calling the subject by name produced more violent disturbances, but these likewise subsided if the subject were not awakened. But if the subject were shaken so that he gradually awoke, there occurred the characteristic expansion of the brain and increased vigor in its pulsations. As the subject fell asleep again, the brain decreased in size and the pulsations again became weaker and more rhythmical.

With regard to emotion Mosso says :¹

“However, the changes in cerebral circulation produced by fear are far greater. The reprimands and threats that I cast at Bertino [the subject], when by moving his head or hands he interfered with the experiment, and the disagreeable things that I occasionally said with intention, invariably produced a vigorous brain-pulse. The pulsations became six or seven times greater than before, the blood-vessels expanded, and the brain swelled and beat with such vigor that my colleagues stared with astonishment at the photogram of the tracings.”

From these facts it should be evident that there is really nothing remarkable in the ability of a stammerer or a mildly aphasic patient to speak when alone, though he may be unable to speak in the presence of other people. The mere presence of another person, and the greater effort of attention required for conversation, causes an increased flow of blood to the brain ;

¹ “Die Furcht,” p. 73.

and this, on account of existing abnormal cerebral conditions, induces auditory amnesia. It is a noteworthy fact that auditory images frequently occur during sleep with persons that have no auditory imagery during the waking state. This fact suggests that the greater supply of blood to the brain during the waking state results in a lowering of the activity of the auditory centre. When the imagery is fugacious during the waking state, it is probably expunged by the cerebral plethora attendant upon increased intellectual activity.

Temporary cerebral hyperæmia is probably the cause of stammering in many cases where no organic lesion exists. The cortex of the brain has an extremely rich blood-supply; and any disturbance in the cerebral vascular system at once reflects itself in consciousness. When the vessels become unduly distended, auditory imagery is doubtless inhibited, and stammering results. If a mild organic lesion should exist, the cerebral congestion would aggravate the condition and thus produce disturbances in consciousness. Hence it is possible for amnesia to supervene only when mental activity exceeds a certain point. During mental repose — when the person is alone, for instance — no disturbance in speech appears.

The mental imagery is most likely to be obscured when the subject is affected by intense emotion. Under these conditions cerebral congestion is greatest.

When temporary stammering or aphasia is induced by stage fright or other emotions, it is probably due to the excessive distension of the cerebral vessels. The subjective condition is one of mental cataplexy. When speech-defects are originally induced by emotional shock, there is probably a rupture of some of the finer vessels in the cortex.¹ Rupture of the larger vessels results in paralysis or death. This rupture of the blood-vessels of the brain is known as cerebral apoplexy.

Disturbances in consciousness are produced by any abnormal condition in the cerebral blood-supply. Cerebral anæmia is just as pernicious as cerebral hyperæmia. In a person suffering from anæmia, aphasia or stammering may occur because the blood-supply to the brain is deficient. A stoppage in one of the cerebral vessels will often cause aphasia by inducing ischæmia, or local anæmia.

It will be seen from the foregoing pages that stammering and aphasia are allied in a great many respects. They are induced by the same causes. They manifest many of the same symptoms — the occasional ability of the subject to read fluently, to speak well when alone, to speak fluently under the influence of

¹ Ssikorski finds that emotional shock is responsible for stammering in practically three cases out of four. ("Ueber das Stottern," p. 232 and p. 235.)

sthenic emotions, etc. They are both more common in males than in females. And, finally, there is no strict line of demarcation between them. Stammering often begins as mute-aphasia, and it is often sufficiently severe at all periods of its manifestation to be regarded as aphasia pure and simple. The specific form of aphasia to which stammering is allied is auditory amnesia, or auditory aphasia.¹ It has been demonstrated in numerous ways that the stammerer's difficulty is due primarily to the failure of the auditory verbal image, his difficulty manifesting itself on that part of the word that cannot be readily produced kinæsthetically — *i.e.* on the vowel. When the acoustic image is subtle and indefinite, he has greater difficulty in recalling it. Hence, he more frequently stammers on, or mispronounces, the short vowels. When the auditory image is definite and tangible, the stammerer can more readily recall it. Hence he stammers little on the long vowels and rarely hesitates in singing. When the primary auditory image is clear, his difficulty vanishes. Therefore he repeats readily, and speaks fluently in unison with other persons.

Thus the arguments are practically conclusive in support of the thesis that stammering is a form of auditory amnesia. But since stammering has been regarded by most investigators as some obscure and

¹ Amnesia is the subjective condition; aphasia rather the objective.

undiagnosable form of subcortical motor aphasia, or aphemia, it might be well to consider the arguments against this latter theory.

If stammering were due to an organic lesion in the neural mechanism actuating speech, it would often be accompanied by some degree of hemiplegia. However, hemiplegia is almost invariably absent in stammerers. Even when the disorder is suddenly induced by emotional shock, there is usually no symptom of paralysis. The writer has seen only one case of stammering (among approximately two hundred) in which paresis existed. There was in this instance a mild paretic condition of the right arm. But in this case the speech-disorder could scarcely be classified as stammering. The disturbance was of a motor nature. There seemed to be difficulty in articulating the consonants; but when these were pronounced, the vowels were readily subjoined. Speech was lethargic and heavy, and it had few of the usual characteristics of stammering.

If stammering were a form of aphemia, it would be impossible to effect even a temporary cure by elocutionary methods, for elocutionary exercises can have practically no effect upon those parts of the brain that do not subserve consciousness. Yet more or less transitory "cures" are effected by elocutionary training in a few instances. The explanation for the improvement in speech is probably that the

vocal exercises effect a transitory intensification of the auditory imagery.

The supposition that stammering is a form of aphemia does not explain the stammerer's greater difficulty with the short vowels. It does not explain his ability to repeat and his ability to sing. To generalize, the theory does not explain the stammerer's ability to speak when he has a clear auditory image of the word he wishes to utter. One might explain this ability on the supposition that the stronger impulsion given to the efferent current by a clear auditory image enables it to overcome an abnormal resistance in the motor cells or fibres. But even when this supposition is made, the cause of the speech-defect — when the subjective aspect is considered — still remains the failure (or in this case the weakness) of the auditory image. But the assumption that there exists an undue sluggishness in the motor mechanism does not explain the fact that the stammerer frequently produces a wrong vowel after his struggles to articulate a word, and the fact that some stammerers experience difficulty only with particular vowels. The existence of a motor defect is disproved by the fact that the stammerer has difficulty neither in articulation nor in phonation. When consonants are followed by long vowels he usually produces them with ease. He never stammers on the consonants at the end of a word. He has no difficulty in phonation, for he often vocalizes

continuously on the continuous sonant consonants. If the difficulty lies neither in articulation nor phonation, it can scarcely be due to a motor disturbance.

Neither can there be a defect in the kinæsthetic verbal memory-centre, for if such were the case, the stammerer would have as much difficulty in singing as in speaking. He would stammer more on the consonants than on the vowels, and would not articulate the consonants freely — as he does in stuttering and many forms of stammering. In many cases the stammerer would be hemiplegic. If there were a defect in the kinæsthetic memory, the stammerer would not be readily affected by slight differences in the tangibility of the auditory image, and would not repeat with his characteristic ease. — One might suppose, to explain the effect of tangibility in the auditory image, that the stronger sound-image arouses the associated kinæsthetic image more promptly. If the kinæsthetic image is the last provocative of speech, this associational process must of course occur invariably in the audito-moteur, — though the awakened kinæsthetic image does not come to the foreground of consciousness, since the speaker attends to the auditory and not to the motor image of the vowel. If the kinæsthetic image of the vowel-movements were sufficiently strong to appear independently in consciousness, the auditory image would be dispensable. In a sense, then, one could attribute the stammerer's

difficulty to a deficiency in his kinæsthetic imagery, but this is only saying that the stammerer is an audito-moteur rather than an articulo-moteur. If he were an articulo-moteur, he would not be a stammerer.

There are cogent arguments against the existence of a lesion in the fibres uniting the auditory and kinæsthetic verbal centres. A defect in either set of fibres would not explain the stammerer's greater difficulty with the shorter vowels. It would not explain his ability to repeat, to sing, and to read aloud in unison with others. We might assume, again, that the stronger auditory image overcomes an abnormal inertia, but we should still have to explain the fact that the stammerer often produces the wrong vowel and the fact that difficulty occurs in some cases only with vowels of a particular coloration. The assumption, moreover, would *still* leave the subjective defect a failure (or weakness) of the auditory image. It seems clear that this theory of the failure of the auditory image is the only one that satisfactorily explains all the phenomena involved.

It is not at all difficult to explain the fact that the auditory faculties are particularly vulnerable, — and more liable to derangement than the motor faculties, for instance. Hearing is one of the distance-receptors, and is a more recent acquisition in the evolution of the human race. It is one of the later terms in evolution, and hence is one of the earlier terms in dis-

solution. The motor faculty is phylogenetically the oldest, for the converting of a sensory stimulus into a motor response is one of the primordial functions of protoplasm. This motor function of the nervous organism is therefore the least likely to be undermined. The auditory function, on the other hand, is relatively vulnerable; and it is liable to derangement by even a minor cerebral disturbance.

Taking the faculty of speech, we find that *vowel-color* is phylogenetically and ontogenetically later in development than *pitch*. Vowel-coloration is, in fact, the *last* term in evolution, and is hence the *first* term in dissolution. Pitch belongs to natural or emotional speech; vowel-color belongs to artificial language. Vowels express nothing in themselves by their coloration. Their use in language (together with consonants) is almost as factitious as the use of writing. Speech-sounds are merely so many symbols arbitrarily associated with different objects and actions in order that the latter may be designated. Natural language, the language of pitch, is found in most of the lower animals, and by means of it they give expression to their emotions. Apes chatter to each other or to an ape-audience; but the sounds that they emit are merely pitch-sounds that express their feelings. In the language of the human child we find that pitch precedes vowel-color. Musical recognition and expression precede the recognition and expression

of language. Long before the child has gained command of language he is able to express anger, fear, and affection by means of sounds of different pitch. These sounds may have the same vowel-color throughout: the child gives utterance to a series of *da*'s, for instance, but he expresses his feeling perfectly by means of the inflection. Pitch is thus older than vowel-color in the development of both the race and the individual. For this reason, appreciation of pitch is less readily lost, and the aphasic patient may understand and give utterance to pitch-sounds when language is no longer expressed or understood. But since vowel-coloration is the last term in development, the memory and appreciation of vowel-qualities is usually the first to be impaired, and these faculties are disturbed by conditions that do not affect the memory or appreciation for pitch. The fact that vowel-coloration is the first term in the dissolution of speech accounts for the position that stammering holds as the commonest of all speech defects.¹

Minor disturbances in faculties other than the auditory and motor undoubtedly occur; but they do not affect speech, and hence give rise to no marked objective symptoms.

¹ Amnesia of *pitch* would not induce stammering even if this form of amnesia were to occur. But the stammerer's difficulty does not lie with pitch, for he produces pitch when stammering on the continuous sonant consonants — and the pitch, moreover, is usually accurate.

That stammering is an auditory disturbance is borne out by the fact that it does not occur in persons not dependent upon auditory cues. Stammering seems to be entirely absent among the congenitally deaf that have been taught to speak. Concerning this matter, Hermann Gutzmann writes as follows:¹

"It is well known that the congenitally deaf *never* stammer — and in Germany, at least, they are all taught by the oral method and gain a thorough mastery of speech. The reason for this is manifest. In the first place, they learn speech under the constant supervision of an instructor; and in the second place, they learn to associate ideas with words only as they slowly and progressively acquire mastery of the articulative organs. The objection — which has been made — that there are stammering children in institutions for deaf-mutes does not affect the validity of the statement; for it is certain that these children are only hard of hearing or that they have become deaf only after normal speech had been acquired. For my part, I have never met a stammering child in a school for deaf-mutes; but I do not disavow the possibility of their existence, which is reasonable enough from the above point of view."

Dr. Gallaudet, President of the Columbia Institution for the Deaf and Dumb (Washington, D.C.), says, in a communication to the writer :

"I have never known a congenitally deaf person who stammered or stuttered."

Concerning the number of orally taught deaf persons he has met, Dr. Gallaudet writes :

¹ "Sprachheilkunde," 2d ed., p. 376.

"I have been engaged in teaching the deaf for more than fifty years, and have visited many schools in this country and Europe. I must have met many thousands of this class of persons."

Gutzmann's explanation for the deaf person's immunity — that he is more carefully taught and that his speech and conceptual faculties develop concurrently — is certainly inadequate. The deaf person is subject to all the usual inducing causes of stammering, infectious diseases, shock, etc., and if there were no more fundamental reason for his immunity, he would certainly fall victim to the disorder as do persons of normal hearing. The reason for his invulnerability is undoubtedly found in his lack of auditory imagery, and the consequent failure of a disturbance in the auditory brain-centre to affect his mental and oral speech. With most congenitally deaf persons there is probably atrophy in the temporal region, but this degeneration has, of course, no effect upon consciousness.

In some cases of stammering the impairment of the auditory imagery appears to be sufficiently severe to entail a mild degree of word-deafness. Denhardt says in reference to the stammerer's interpretation of language:¹

"With extraordinary frequency one observes in the stammerer a certain tardiness of perception, which is in no way due

¹ "Das Stottern eine Psychose," p. 188.

to lack of intelligence, but rather to lack of practice in, and insufficient habituation to, the exchange of thought through the medium of spoken language. It is as though the verbally expressed thought required with the stammerer a longer time than it does with the normally speaking person to reach the seat of intelligence through the ear and to receive its interpretation."

The reader will recognize at once that Denhardt is really describing a mild condition of word-deafness. The occurrence of a degree of word-deafness in stammerers is not surprising. The condition is one that might well be expected to occur under circumstances that oblige the stammerer to give oral expression to his thoughts as well as to listen to the words of other people. The necessity for speaking imposes upon him a mental strain, which, with the attendant fear, is sufficient to stifle the auditory imagery. There is probably a condition of cerebral hyperæmia increasing the inertia of the auditory cells; and this inertia renders the cells almost as slow to receive auditory impressions as they are to yield mental images.

But this word-deafness is not present solely during mental excitement. The writer has remarked its presence in stammerers during moments of complete tranquillity. It usually takes the form of a tendency to misinterpret vowels. To cite specific instances: *Camp* was misinterpreted as *Kemp*; *Woolley* as *Wyllie* (short *y* or *i*); *man* as *men*; *pen* as *pin*; *sighing* as *sewing*, etc. In actual speech, the stammerer's vowels

are often far from pure even when the impediment is not in evidence. He is frequently misunderstood, or, rather, un-understood; and is consequently called upon to repeat — much to his embarrassment. As regards misinterpretation of vowels, it is certain that this occurs with some degree of frequency in persons of normal speech; hence it is impossible to say from casual observation whether or not the phenomenon occurs more frequently among stammerers. The matter is one for investigation in the psychological laboratory. Apparently the average non-stammerer is not remarkably apt at interpreting sounds. When Wyllie made his interesting experiments in the perception of an apple through different senses, he tested a number of persons by paring an apple with a table knife, holding it near the ear of the subject.

“Sixteen persons in all, mostly adults, were tried in this fashion, and of the whole number only three answered correctly, ‘You are paring an apple.’ The others thought we were paring wood, clipping paper with scissors, rubbing salt, rubbing two surfaces of cloth together, etc.”¹

In view of these remarkable results it behooves one to be conservative in drawing conclusions concerning the *relative* ability of the stammerer to interpret sounds and spoken language. The writer is, however, of the opinion that a large proportion of stammerers manifest

¹ Wyllie, “Disorders of Speech,” p. 228.

some degree of word-deafness under such conditions as induce severe stammering; *i.e.* under conditions that subvert the auditory imagery.

The writer has endeavored to ascertain the nature of the mental imagery possessed by the average stammerer. The method employed was the circulation of a questionnaire. A general description of mental imagery, similar to that given in Chapter I, accompanied the question-forms, for most of the subjects had, unfortunately, little knowledge of psychology. The questions employed were as follows:¹

¹ The writer would appreciate replies to this questionnaire from any of his readers that happen to be stammerers and have some knowledge of psychology. A general description of the mental imagery of each type would, of course, answer the purpose. Information is desired especially in regard to the auditory imagery and the verbal imagery. The motor imagery — especially of articulative movements — is also important. If the reader should confine himself to the questions here given, it might be well to observe the following directions, which prefaced the questionnaire in its original form :

“Read the questionnaire through before beginning to reply. Do not trouble to repeat the questions; refer to them simply by number. Make your answers as complete as possible, avoiding where practicable such replies as *Yes* and *No*. If unable to answer a question, state the fact frankly. Usually it will answer itself at some moment when you are watching your thoughts.

“Be careful not to describe the image of a sensation that you have just previously experienced. Such images, are, as a rule, exceptionally vivid. Confine your description to images of sensations that have not occurred within the preceding five or ten min-

QUESTIONNAIRE¹

1. Think of some person who is well known to you, but whom you have not seen for some little time. Do you clearly see the features; the outline of the figure; the color of the clothes? Do you seem to see the person through a mist, or in a very poor light?

2. Have you a distinct memory for the scenes that you observe in daily life? Do the objects appear to you in a clear light, and with good definition? Are the colors natural?

3. Can you picture scenes described in a novel?

4. How do your visual images differ from objects as you actually see them?

5. Imagine yourself brushing your hair. Do you distinctly feel the arm-movements that you would employ?

6. Can you in memory revive the hand-movements involved in writing your signature? Do you either hear or feel the scratching of the pen upon the paper? Does the performance seem awkward as you imagine yourself writing with the left hand?

7. Can you imagine the (touch) sensations that you would get from handling a piece of sandpaper; a wet cake of soap; a crisp, dead leaf?

8. Can you mentally distinguish the feeling of a handful of sand from that of a handful of sawdust? Can you, by your memory for feeling, mentally distinguish silk from velvet; a light pin-prick from a deep pin-prick; a snowball from a ball of dough?

utes. It is advisable to make these tests under conditions of quiet, in order to facilitate concentration of attention. Closing the eyes will frequently intensify the mental images."

¹ Some of these questions are taken or adapted from standard questionnaires.

9. Can you imagine the feelings of different objects as you think of yourself groping in the dark?

10. Can you recall the odor of violets; of cheese; of tobacco-smoke; of frying bacon?

11. Can you recall the taste of a lemon; of salt; of sugar; of some bitter substance, such as quinine?

12. Can you imagine the scalding sensation from coffee that is too hot to drink? The coldness of ice-cream?

13. Do you get an image of pain as you imagine yourself slashing your wrist with a knife?

14. Hold your hands as though about to clap them together. Can you distinctly hear the sound that is about to occur? Now strike the hands together and compare the sound with your auditory image. Was the latter clear and accurate?

15. Hold your fingers ready to snap them. Can you clearly think of the sound in this case? Verify the image.

16. Go to the window and hold your hand as though about to tap the pane with the knuckles. Can you distinctly imagine the sound that is about to occur? Verify by tapping the pane. Was your image vivid and accurate, or were you totally unable to think of the sound?

17. Can you hear in memory the beat of rain against the window-panes; the crack of a whip; a church bell; the hum of bees; a train-whistle; the chirping of sparrows?

18. Can you call to mind *instrumental* music so that it gives you pleasure?

19. Can you, at will, imagine tunes on different instruments, — the piano, flute, cornet, etc.?

20. Do you play any instrument by ear?

21. Do you sing to entertain friends?

22. Do you frequently have tunes running through your head? If so, do you hear such tunes on an instrument, or do you mentally sing them in words?

23. Can you *mentally* whistle a melody?
24. Can you clearly recall the voices of your friends? Do you recall voices or faces more readily?
25. As you read a letter from a friend, are the words in your own voice, or unmistakably in the voice of the writer?
26. Do you imagine a different voice for each character in a novel?
27. When thinking in words, do you *hear* them within your head, or do you seem to be mentally *articulating* them; *i.e.* speaking them with lips, tongue, etc.?
28. Does your thinking voice resemble your speaking voice in quality, volume, pitch, inflection, etc.? or does the voice appear to be nobody's in particular — a sort of standard thinking voice?
29. Does the memory of your whispering voice seem to differ from that of your speaking voice? (Make the comparison on the normal inward breath, and not while exhaling.)
30. Open the mouth, and without moving the lips read silently the following words: *wobble, bubble, toddle, woman, mimicry*. Do these words appear thick and unnatural, as though you were attempting to speak with the lips apart?
31. Do you ever move the lips when reading silently?
32. Do you, when speaking, have visual images ("printed" or "written") of the words that you utter?
33. Can you hear in imagination the barking of a dog? The crowing of a cock? Do you clearly *hear* the sounds, or does it appear that you are mentally *saying* them? Are your images unmistakable animal cries, or merely the conventional "bow-wow" and "cock-a-doodle-doo"?
34. Imagine yourself tapping a tea-cup with a spoon. Can you mentally hear the clinking sound? Do you feel yourself manipulating the spoon? Are visual images present?
35. Imagine yourself firing a revolver. Do you feel the

weapon in your hand? Do you feel yourself pulling the trigger? Is the report clear and sharp? Do you mentally stand off and see yourself performing the act? Are you able to do this if you wish?

36. When the word *violin* is suggested, do you think first of the appearance of the instrument or of the sounds made when it is played?

37. Think of a train. What mental images are present in the thought?

38. Give your mental image-types in order of decreasing intensity.

39. Give any supplementary information that may occur to you in reference to your mental imagery.

Further questions were given concerning the relative difficulty experienced with long and short vowels, and concerning the stammerer's ability to repeat words spoken by others, to speak in unison with others, to sing, etc. In every case the replies bore out the statements already made in this chapter concerning the various paradoxes of stammering.

Several of the subjects clearly indicated by their replies that they had experienced the amnesia during speech — and none of them, by the way, knew anything of the theory the writer is advocating in the present monograph. Two of the correspondents stated that they found the mind to be absolutely blank when they stammered. Had they been versed in psychology, they probably would have said that there was an occurrence of auditory amnesia. Most

of the subjects stated, in reply to a question, that they would intuitively recognize an *unfamiliar* word as difficult — the name of a person or a town, for instance. This means either that the auditory image disappears during silent thought¹ or that the kinæsthetic image of the word is distorted. (The subject of distorted imagery will be discussed later.) With an absolutely strange word, it is more likely that the former condition prevails.

The writer gives here a set of his answers to the questions. He finds it necessary to give his own answers rather than those of his correspondents because, unfortunately, none of these subjects were trained in introspection.

(1) The features, the outline, etc., are dim. The figure appears as through a dark mist or as though seen on the outer edge of the field of vision. The figure, however, is at the centre of the mental visual field. There is practically no color in the figure till I actually look for it. Then the colors are faintly discernible. I can just distinguish them as I would distinguish real colors in relative darkness.

¹ The average stammerer will probably find upon introspection that auditory amnesia not infrequently occurs during silent thought. The auditory nucleus then drops from the word, leaving a kinæsthetic outline. This imperfect image is quite sufficient for silent thought; for it is the function of the word — its associations, and not its intrinsic content — that is significant. But the image is not adequate for oral speech. The speaker must know not merely what the word means; he must know, further, how the word *sounds*.

(2) My visual images of scenes are pictorial abortions. The light is poor to the last degree, and the mental picture is lacking in detail. The picture appears in light and shade rather than color. I can introduce color only by an effort of attention. Even then the color is not usually distinct.

(3) Scenes that I imagine are about as clear, or dim, in my mind as scenes that I remember.

(4) The imagery described in answers (1) and (2) is quite typical. My visual images are commonly lacking in color and detail, and the illumination is defective. In this respect the images are like pictures taken from a bad negative: they show the contour and body of an object, but none of the finer points. I find that the detail is brought out at a particular point of the image only by direct attention to it. On the whole, my visual images are so vestigial that I almost wonder how I think. Yet, when my visual images become detailed and colored, as sometimes happens during extreme fatigue, I find that the clear optical images are distracting. They seem to divert the attention from the relations existing between them, and thus they impede abstract thought.

(5) The arm-movements are almost as distinct as though I actually made them. Mentally, I can execute almost any muscular movement, and can "feel" the movement with great clearness.

(6) I can feel the hand-movements with great distinctness. I feel the movement of the pen over the paper, and feel the variations in pressure. The pen, however, moves silently. The performance is just as awkward when I write mentally with the left hand as when I do so in fact.

(7) All of these touch-sensations are very clear. My tactile images are scarcely less vivid than my kinæsthetic images. I can feel the sharp grains of sand as I handle the sand-paper. I can feel the wet and slimy cake of soap, and by a movement

of the thumb and fingers can turn it over and over in my hand. I feel the sharp edges of the leaf as I crumble it in my hand.

(8) I can make all of these distinctions quite readily. In the case of the pin, however, I distinguish a mere touch from a light pin-prick. I cannot get a very distinct image of pain as I imagine the heavier pressure of the pin.

(9) These images occur with great vividness.

(10) The olfactory images do not appear to be very clear, and I meet with little success as I endeavor to think of the odors in the order mentioned, though for a moment I get a faint mental image of the odor of the bacon. Olfactory images are, however, sometimes quite vivid in my consciousness, and a distinct image will occasionally rise without any overt associational connection.

(11) These gustatory images are not very clear, though I get a fairly good image of the taste of the lemon. Taste-images often seem to me to be quite intense, but I find upon analysis that this is due in large part to the prominence of the tactual element; the actual gustative element is often relatively weak.

(12) The thermal images are fairly clear, though by no means so strong as the normal touch-images.

(13) There is not a clear, localized image of pain, though I distinctly feel the touch of the knife. The flesh seems to be analgesic but not anæsthetic. The thought of cutting my wrist is accompanied by a distinctly disagreeable element that seems to take the form of a general chill.

(14) I can get absolutely no image of sound. I can mentally feel and see the movements that my hands would make, and can mentally feel the contact of the hands; but I am deaf to the sound that would occur.

(15) Utter silence.

(16) *Ditto*.

(17) I find it impossible to think of these things in terms of

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ound. The thoughts are visually represented. In the case of the whip and the bell there are also motor images: I mentally rack the whip and pull at the bell-rope. No sound, however, supervenes.

(18) Am quite unable to recall instrumental music.

(19) Impossible.

(20) No.

(21) No.

(22) I can occasionally recall a tune; but this is often inaccurate. I must always associate the tune with words. The words I find to be auditory-motor.

(23) No.

(24) I find it practically impossible to recall voices. Sometimes I can associate the timbre of a person's voice with some simple expression, such as "Good morning," or with a single word like "Yes" or "No." In this case I find that I am saying the word with the other person's voice; *i.e.* I *feel* the word as I hear it.

I of course recall visual images of faces more readily than this.

(25) Always in my own thinking voice.

(26) The characters all have the same voice; that is, my own thinking voice.

(27) I mentally feel the different speech-movements and mentally hear the vowels. Occasionally I have an acoustic image of a sonant consonant like *m* or *n*, but these images are not very conspicuous.

(28) The acoustic element in my mental voice varies greatly. Occasionally it possesses unmistakable timbre, and then the timbre, of course, resembles that of my speaking voice. On such occasions the volume, pitch, and inflection can also be detected; but these elements are felt as well as heard. When the acoustic element in the voice happens to be weak, all timbre

virtually disappears. The voice then loses its character and becomes a sort of standard thinking voice; *i.e.* it is predominantly kinæsthetic. But even under these conditions it possesses pitch and inflection, these elements being represented to some extent in terms of feeling.

(29) I find that the acoustic intensity of my voice is practically the same whether I mentally whisper, speak aloud, or shout. The only difference detected is in the "effort" put forth.

(30) The mental words appear thick and unnatural.

(31) Yes, occasionally; and especially if the lips should momentarily be apart.

(32) These images do not usually appear; but by an act of conscious attention I can arouse visual images of words fairly readily. But though these images appear promptly, they are not at all distinct.

(33) I am mentally saying the *words*. The words are auditory-motor.

(34) I can picture the scene and can mentally feel myself manipulating the spoon. I can feel and see myself striking the teacup, but I do not get an image of the sound.

(35) I see my arm before me and see the weapon in my hand. I distinctly feel the revolver and feel myself pulling the trigger. I can see the smoke and can feel the "kick," but I do not hear the sound. Now I can mentally stand off and see myself go through the performance. The image is about as clear — or dim — as any other visual image, but I have no trouble in reintegrating it. The revolver is again of the noiseless type.

(36) I think of the appearance of the instrument. I cannot think of its sound.

(37) I am standing about a hundred feet from the railway, and I see the train go rapidly and silently past me. I can see

the contour and body of the train, but I see practically none of the details unless I look for them individually.

(38) Motor and Tactile.

Visual.

Thermal and Algesic.

Gustatory.

Olfactory.

Auditory.

(39) Although my visual images are vestigial, I find that they predominate in my thinking. Much of my abstract thought proceeds in visual imagery. These visual images are often diagrammatic, and various parts of the image or various images then move in such a manner as to express relations. Often the relation is expressed by an eye- or hand-movement in motor terms. Very little abstract thought seems to occur in verbal imagery. I can usually think more freely and more rapidly if I do not stop to express my thoughts in words.

I not infrequently experience strong auditory images during dreams, and I have found these images to occur during fever. But during the waking state no sound-image enter my consciousness except the sound-images associated with my verbal thought.

It is somewhat difficult to say whether the lack of auditory imagery indicated by these answers is characteristic of the average stammerer. The writer is inclined to believe that such is the case. Very few stammerers possess a "musical ear." Charles Lamb probably spoke for the majority of stammerers when he said, "Sentimentally, I am disposed to harmony; but organically, I am incapable of a tune." Among approximately two hundred stammerers the writer

has known only two that were able to sing without disgracing themselves.¹

Several writers have remarked the defective ear of the stammerer. Klencke says:²

"I put notes by the side of the vowels to indicate the key in which they are to be produced. By so doing, the patient acquires the use of his voice in its full compass and cultivates his ear for the tone, in distinguishing which nearly every stutterer [stammerer] is defective."

And thus Albert Gutzmann:³

"If a child cannot distinguish a high from a low tone by the ear (I have often found that with adult stuttering persons) he may put his hand on the larynx of the teacher or of another child and notice the difference by feeling, for the larynx rises for the higher tones and sinks for the deeper ones."

Not every stammerer, however, is lacking in general auditory imagery. The replies to the writer's questionnaire⁴ show (if they may be regarded as reliable) that the imagery is sometimes fairly strong. As regards the acoustic imagery of ordinary physical sounds and music, the replies exhibited the two extremes as well as the different degrees between them. In some cases there was no memory whatever for ordinary

¹ One of these had incurred his impediment through imitation.

² *The Voice*, Vol. I, p. 112 (from a translation of "Die Heilung des Stotterns").

³ Albert Gutzmann, "The Cure of Stuttering" (*The Voice*, Vol. V, p. 83).

⁴ About two dozen sets of answers were received.

sounds, and in other cases most sounds were apparently represented.

There seems, however, to be no necessary parity between the acoustic memory for ordinary sounds and the acoustic memory for words. Ballet says in reference to this matter:¹

"We know a distinguished musician that is endowed with a remarkable memory for sounds; but he recalls words by invoking his visual rather than his auditory memory."

The existence of clear musical imagery or clear general auditory imagery does not therefore *necessarily* indicate the existence of a clear auditory memory for words.

The writer's correspondents were unanimous in the statement that they both heard and felt their words when thinking them. The acoustic element seemed subject to a good deal of variation, some correspondents stating that the thinking voice resembled the speaking voice in timbre, volume, etc., and others stating that verbal thought took place in "a sort of standard thinking voice"; *i.e.* in a voice in which the acoustic element must be decidedly weak. All agreed, however, that the acoustic element was present. This, of course, is exactly what one would expect.

But it seems probable that the average stammerer

¹ "Le langage intérieur et l'aphasie," 2d ed., p. 28.

has weak rather than strong auditory verbal imagery. It would not be surprising to find that this imagery is relatively strong in a small minority, for the stammerer's difficulty is not occasioned by deprivation or weakness of the auditory imagery, but by transient auditory amnesia. The stammerer *has* auditory imagery, and he relies upon it in speech. Even after the occurrence of the amnesia, the acoustic image must ultimately appear; for if this were not the case, the stammerer would be permanently aphasic. The imagery may, then, in some cases be strong (though one must be conservative in interpreting the statements of non-psychologists); but the amnesia may appear, none the less. The inducing cause of stammering — the emotional shock, fever, or whatever it be — may effect not so much a general enervation of the auditory verbal centre as a functional perversion that renders transitory amnesia likely to supervene. But if this were the case, it would be the person with congenitally *weak* auditory imagery that would be most likely to suffer. The weakness of the imagery would itself be a predisposing cause. It would render the amnesia more liable to appear and more difficult to overcome. For this reason one is impelled to the belief that the average stammerer has weak rather than strong acoustic imagery. The weakness of the imagery is probably in most cases a congenital rather than an acquired defect, the

acquired defect being a functional perversion that at times subverts the imagery that is already dangerously near the point of extinction. When the imagery is congenitally strong, the same functional defect might merely lower its intensity without affecting oral speech.

It would be quite possible, though, for a general weakening of the auditory imagery to induce stammering. The stammering would be more likely to appear if there existed a neurotic tendency that rendered the intensity of the imagery variable. The imagery would then vacillate near its minimum intensity and would repeatedly disappear from consciousness. The combination, weakness of imagery and variability in intensity, would be sufficient to occasion stammering in any person dependent upon auditory cues; and if either of these causes were extraneously introduced when the other was already existent, the impediment would be established.

It is also quite conceivable that a general enervation of the auditory verbal centre might induce stammering even if there existed no marked tendency to variability in the imagery. The general lowering of the intensity of the auditory imagery would probably entail obliteration of some of the less distinctive vowel-colors, and a somewhat equable form of stammering would result. This cause is probably operative in some cases where temporary stammering occurs during the course of a disease or during the succeeding convalescent period.

Variability in the intensity of mental imagery is normal, though extreme or sudden variations probably occur only when there exists a neurotic tendency or some cerebral functional perversion.

Angell says of the normal mental imagery:¹

"To-day this may be principally auditory and verbal, to-morrow largely visual. It may be on the one occasion vivid and detailed, and on the other evanescent and wholly schematic."

Changes in the *verbal* imagery are likewise normal and common. In his "Motorische Wortvorstellungen," Dodge describes the mutations in the verbal imagery of a theological student. The imagery was generally auditory-motor, but at times it assumed a purely auditory form:

"One day he told me that his verbal imagery had been purely auditory during the course of the preceding evening. Not the slightest trace of movement-images was present. This he had determined during a period of quiet introspection. At the time that he made this communication to me, the motor element was again the prominent, and apparently the exclusive, [?] constituent of his mental speech. He informed me on subsequent occasions that the motor element in his verbal thought would sometimes completely disappear for several hours.

"He was not able to produce this change in the character of his verbal imagery at will. The auditory verbal imagery seemed to confine itself to hours of quietness and repose. Apart from this, no regularity could be observed."²

¹ "Psychology," p. 253.

² "Motorische Wortvorstellungen," p. 36.

It is probable that the motor images disappeared when the auditory images became sufficiently intense to represent the verbal thought independently. This particular case shows only the *intensification* of the auditory imagery. Its obfuscation may or may not be common among persons of normal speech; but it is certainly common among stammerers. A correspondent says, in reply to the questionnaire:

"When thinking in words, I sometimes hear them and sometimes seem to be mentally articulating them. When my speech has been annoying me, I always think in the latter way."¹

The latter remark suggests that failure to hear the words was the cause of the stammering. The remark is significant: it supports the belief that a general obfuscation of the auditory imagery renders the amnesia more liable to appear and more difficult to overcome.

The increase or decrease in the intensity of the mental imagery may endure for hours, days, weeks, or months. The mutations are primarily attributable to minor changes in the physical condition, — physical changes in the nervous system that do not always manifest themselves in definite feelings. Fatigue, sleeplessness, or an attack of indigestion may obfuscate the mental imagery, and the stammerer finds that for some unaccountable reason he is experiencing greater difficulty in speech. On the other

¹ The correspondent knew nothing of the theory advanced in this monograph.

hand, the tone of the nervous system may temporarily improve, and forthwith the auditory imagery is intensified. All traces of the impediment may disappear, and for a time the stammerer enjoys complete immunity from his defect. If the improved tone of the nervous system is due to a change of climate, the stammerer may have no difficulty in speech for weeks or months at a time. But the speech-disorder recurs as soon as he becomes acclimated, or as soon as some minor physical disturbance adversely affects him.

These mutations in speech-disturbances may or may not be due exclusively to the vicissitudes of the auditory imagery, but certainly they are attributable to them in large part.

The desideratum in speech is either strong auditory imagery or no auditory imagery at all. The strong imagery renders one immune from speech-disturbances when slight variations in its intensity occur; the absence of the acoustic imagery renders variation impossible. It is the fugacious and vacillating auditory imagery that causes the stammerer's trouble. The auditory imagery is always, as it were, in unstable equilibrium. The sound-image is continually disappearing from consciousness, and the stammerer is left struggling for a foothold in space.¹

¹ The reader that is a non-stammerer can readily comprehend the nature of a fugitive image by watching the gradual evanescence of a

It is interesting to note that many authorities regard stammering as an hereditary defect. Wyneken says on the matter:¹

"One cannot escape the fact that there exists in many cases a certain inborn predisposition to stammering, which cannot be eradicated by the most careful training."

Denhardt regards stammering as inheritable. Among 1994 cases of stammering he found evidence of heredity in 1545; that is, in approximately $77\frac{1}{2}$ per cent.²

Doubtless many cases of stammering ascribed to heredity are in reality due to unconscious imitation.

visual after-image. Let him take a small square of red paper and place it upon a white background. Let him then fixate a pin-prick at the middle of the square for 15 or 20 seconds. When the square is removed, a green after-image will appear upon the paper.

This after-image assumes various degrees of vividness. At first the outline is well defined, and the color intense. Gradually the sharp boundaries disappear, the angles vanish, and the contour is obliterated. Simultaneously the color fades, and finally nothing remains but a dim, colored haze. In its turn, this haze disappears, and the after-image has vanished.

This after-image may be regarded as illustrating the various degrees of intensity in auditory images. The ideal auditory image for the incitation of speech is the one analogous to the square with its sharpest outline and coloration. The image as it exists in many persons — and probably in most stammerers — is comparable to the after-image shortly before its disappearance. The amnesia of stammering is represented by the visual blank by which the image is succeeded.

¹ "Ueber das Stottern und dessen Heilung," p. 10.

² "Das Stottern eine Psychose," p. 91.

But this explanation will not hold in all cases, for often there is no association between the related stammerers. In the latter cases there is probably an inherited weakness of the auditory imagery or an inherited neurotic tendency entailing marked variability in the imagery. Either of these factors would predispose the child to stammering; and if the other factor should supervene, the speech-disturbance would be established. In some cases it is probable that both factors are inherited — though not necessarily from the same parent; and the child might then be said to inherit his stammering.¹ The stammering might not develop if the neurotic tendency were to manifest itself at an early age, for the child would then probably learn to depend upon his kinæsthetic imagery. But if the neurotic tendency were not displayed till the child had acquired command of language, stammering would inevitably ensue.

The form of stammering that has been considered up to this point is *pure stammering*; i.e. stammering *directly* due to auditory amnesia, and uncomplicated by extraneous symptoms. The blind struggles of the stammerer — the facial contortion and physical effort — are mere epiphenomena. They are secondary

¹Davenport gives pedigrees of two stammering families in his "Heredity in Relation to Eugenics." He inclines to the view that stammering is a recessive characteristic. It is probably incorrect, however, to regard stammering as a unit character.

manifestations of the defect. This latter form of stammering may be designated *secondary*, or *physical*, *stammering*. The third form of the defect, *acquired kinæsthetic stammering*, is due, like the first, to mental causes. It is stammering occasioned by perversion or distortion of the mental imagery of speech. This perversion of the verbal imagery may result from association with or imitation of other stammerers, or it may arise as the direct result of one's own stammering, the process being, as it were, one of auto-intoxication, or self-infection.

We shall now consider the characteristics of these forms of stammering a little more closely.

PURE STAMMERING

The forms of stammering directly due to auditory amnesia may be roughly classified. The classification is of no particular value except that it serves to establish one's conception of pure stammering.

When pure stammering manifests itself on the continuous consonants, it usually takes the form of a prolongation of the initial sound. In the word *few*, for instance, a continuous fricative sound is produced till the vowel appears. If the initial consonant happens to be sonant, a continuous vocalization accompanies its production. Strictly speaking, the vocalization is part of the consonant, for without vocalization the consonant would be surd. It sometimes happens,

however, that the "sonant" consonants are produced without voice. This surdal stammering on the continuous sonant consonants can be regarded as pure, for the prolongation of the consonant is directly due to the auditory amnesia.

A form of interruptive or repetitive stammering sometimes occurs on the continuous sonant consonants. This form of the defect is frequently "diagnosed" as stuttering. It is evident that the distinction between stammering and stuttering is artificial. Repetitive stammering is not due to disturbances in respiration or to occlusions of the glottis, but rather to the execution of articulative movements that are not directly succeeded by the vowel. The stammerer attempts to say *six*, but produces a series of short sibilant sounds. The word then becomes *s-s-s-six*. He attempts to say *London*, but repeatedly articulates a surdal or sonant *L*. In both cases the stuttering articulation is directly occasioned by failure of the auditory image. Occasionally a silent pause occurs between the consonant and the vowel. This form of stammering rarely appears, however, on the continuous consonants.

All other forms of stammering on continuous consonants, such as manifestation of lingual or labial effort, must be regarded as secondary.

There are three different varieties of pure stammering on the explosive consonants. The first variety is

the disjointed speech described by Kussmaul, in which there is a distinct lacuna between the consonant and the vowel. Instead of saying *Kommen and Kaffee*, the speaker says *K—h—ommen and K—h—affee*. He articulates the consonant, — using kinæsthetic cues, — then waits passively for the auditory image to appear. This particular form of stammering exactly reflects the verbal image of the word. It is the purest form of stammering that can occur on the explosive consonants.

In the second form of stammering on explosive consonants the articulatory organs are held passively in position till the auditory image rises in the mind. The word is articulated as soon as the sound-image appears, and no marked incoördination is perceptible to the ear,—a delay only is heard. The stammering appeals chiefly to vision; it can be seen that the articulatory organs take their initial position and hold it for an abnormal length of time. This form of stammering is really somewhat of an accomplishment: it is the stammering of the virtuoso. The stammerer essays to retard the consonant — without repeating it, or “holding” it with undue pressure — till the vowel is ready to appear. The difficulty is, however, that the stammerer cannot always tell just when the vowel is ready to appear; and when he produces the consonant, he may find that his articulation has been premature, and before he finally gets the vowel, the stammering may be decidedly evident.

The third variety of stammering on the explosive consonants takes the repetitive form. The sonant consonants are sometimes produced as surdal, but the surd consonants are practically never vocalized.

This exhausts our classification of pure stammering.

The assertion is made by some writers that stammering occurs more frequently on the explosive consonants than on the continuous consonants. The disparity is slight, if it exists. There seem, however, to be mechanical and psychological reasons why greater difficulty should be experienced in subjoining the vowels to the closed consonants; hence, if stammering does occur more frequently on these consonants, the fact need not indicate that the consonants themselves are difficult.

When a word commencing with a sonant explosive consonant (*B* or *D*, for instance) is articulated, vocalization commences in advance of articulation. When the articulatory movement is produced, the vowel must follow instantaneously; otherwise stammering results. Vocalization is already under way, and the vocal stream must be shaped immediately to the appropriate vowel. With the surd explosive consonant (*P* or *T*, for instance), no less dexterity is required. The consonant is exploded by a non-vocalized stream of breath; but as soon as articulation takes place, the stream of breath must be vocalized

and given its requisite color. If for any reason the latter process is delayed, stammering results. It is evident, then, that for fluent enunciation of words commencing with explosive consonants, the auditory image must be at the instant command of the speaker. The slightest delay in its appearance produces abnormal speech.

So delicate a control of the vowel is not required for the continuous consonants. The speaker commences the initial consonant — a *V* or an *M*, for instance — and sustains it till the vowel appears. Instantaneous production of the vowel is not necessary, for it makes no difference whether the consonant be continued for a fiftieth part of a second or for a whole second. Hence a less delicate control of the auditory image is required. If the vowel is delayed for a half a second, the consonant is continued so much longer. The *continuous* consonants can be continued, but the explosive consonants can not. If the vowel is delayed for a half a second with the closed consonants, stammering must inevitably result.

These facts should account for whatever disparity exists in the amount of difficulty experienced with the two forms of consonants. There is another fact that might account for the more frequent occurrence of stammering on the closed consonants. Physical stammering is usually greater on these consonants; hence they are more likely to be affected by acquired

kinæsthetic stammering due to distortion of the mental imagery. This matter will be better understood after the subject of distorted imagery has been more fully discussed.

SECONDARY, OR PHYSICAL, STAMMERING

It will be noticed that up to this point practically nothing has been said concerning labial and glottal "spasms," "paroxysms of stammering," etc. These "spasms" constitute nothing more nor less than the stammerer's misdirected efforts to overcome his difficulty. They are often regarded, however, as the primary defect. The following paragraph exhibits a fairly typical point of view:

"The most distressing cases are those in which the spasm extends to parts unconnected with speech, — it may be to nearly the whole muscular organism. In such a case the spasm commences, let us assume, at the base of the tongue; the mouth opens widely and remains in that position; the muscles of expiration work convulsively; the glottis contracts; respiration becomes arrested; the face becomes congested and the veins dilated; violent spasmodic movements involve the trunk and limbs; and only after some time, either when the patient becomes exhausted, or when he resolutely restrains his attempt to articulate, does his paroxysm come to an end."¹

These "spasms" are, of course, neither the stammering nor the cause of the stammering. Strictly speaking, stammering is little more than a *failure* of

¹ "Quain's Dictionary of Medicine," 1st ed., p. 1513.

speech due to the non-appearance in consciousness of the auditory image. It is the inability to complete a word that may or may not have been begun. The primary disturbance is essentially passive. The "spasms" and contortions are nothing but an excrescence on the disorder. They are the blind and impotent struggles of the stammerer against an invisible adversary. Physical stammering is purely voluntary. It is not always deliberate: it is often the product of bewilderment. But it is voluntary in this sense — that it can at any moment be inhibited. Often the stammerer summarily relinquishes the attempt to speak, and thereupon the so-called paroxysm is at an end. Physical stammering is occasioned solely by the speaker's ignorance of the real nature of the disturbance. When the vowel-image fails to appear, the consonant is either not articulated or it is rapidly repeated. Hence the stammerer sees in the consonant the apparent cause of his difficulty, and resorts to physical effort to overcome it. He presses the lips together, tightens the muscles of the throat, clenches the fists, and may work even his arms and legs in an effort to *articulate*. But, since articulation itself causes no difficulty, his efforts are entirely misdirected.

Physical stammering may, in many cases, lead to obfuscation of the verbal imagery. A case is on record in which a subject could stop his internal

language by simply holding the breath.¹ The average person with marked kinæsthetic images of speech will find that the act of inhibiting respiration restrains the internal language. Thus it is clear that physical stammering may aggravate the amnesia.

The brain expands more during expiration than during inspiration.² This being the case, it is evident that the common practice of stammerers of exhausting the breath may increase cerebral congestion, and thus likewise aggravate the amnesia that directly induces stammering.

The secondary manifestations of stammering are so multiform that the task of classifying them would be arduous to the last degree. The writer has no intention of undertaking the task, for the work would be worthless when complete. Ssikorski has written a chapter on the symptomatology of stammering, and he commences it as follows: ³

"The manifestations of stammering are so varied and complicated that the investigator engaged on this neurosis must perforce ask himself whether there exists a single disturbance or a number of disturbances that have been grouped together on account of insufficient analysis. The external manifestations are so diverse that it seems impossible to compare and classify the symptoms of the different cases."

¹ *Annales Psychol.*, January, 1893, p. 103. (Quoted by Baldwin, "Mental Development of the Child and Race," p. 434.)

² Leonard Hill, "Cerebral Circulation," p. 13.

³ "Ueber das Stottern," p. 44.

The succeeding 143 pages of Ssikorski's monograph contain his attempt to correlate the various "spasms" that occur in stammering. All the different "spasms" are classified and described — from those in the upper lip to those in the lower extremities. The work is a monument to the author's thoroughness and patience, but its value is unfortunately negligible.

A remark may be made at this point concerning the frequent self-exacerbation of physical stammering. It will be remembered that a muscular movement is initiated by a mental image of its resident or remote effect. The resident effect is the kinæsthetic sensation. If this resident sensation gets to the focus of attention during the mental hiatus occasioned by the auditory amnesia, it may, apparently, augment the muscular contraction by assuming the function of the inciting image. The excessive muscular contraction that results constitutes a pseudo-spasm; and it is this "spasm" that has led the objective observer astray. But, as already stated, there is no spasm in the real sense of the word. At any moment the will can step in and inhibit the process. All that is necessary is that something other than the kinæsthetic sensation be placed at the focus of attention. To secure this condition the stammerer has often to relinquish the attempt to speak.

The following paragraph gives James's account of

the manner in which a sensory stimulus normally brings about a motor response. (Figure 6, to which the letters refer, represents the nervous system reduced to its fewest possible terms.)

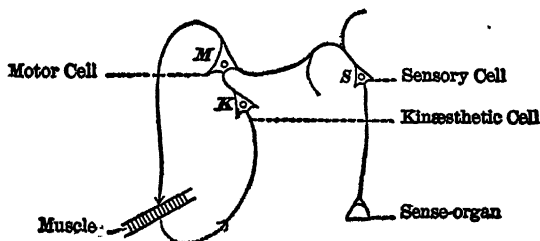


FIG. 6.

"A stimulus reaching the sense-organs awakens the sensory cell, *S*; this by the connate or instinctive path discharges the motor cell, *M*, which makes the muscle contract; and the contraction arouses the second sensory cell, *K*, which may be the organ either of a 'resident' or 'kinæsthetic,' or of a 'remote' sensation. The cell *K* again discharges into *M*. If this were the entire nervous mechanism, the movement, once begun, would be self-maintaining,¹ and would stop only when the parts were exhausted. And this, according to M. Pierre Janet, is what actually happens during catalepsy."²

Each elementary movement must be regarded as possessing its own motor circle. The complex movements required for the articulation of a word would involve several motor circles.

¹ This circle of neural activity James calls the "motor circle."

² James, "Principles of Psychology," Vol. II, p. 582.

In regard to the continuous discharge through a motor circle, James says :¹

“We should all be cataleptics and never stop a muscular contraction once begun, were it not that other processes simultaneously going on inhibit the contraction. Inhibition is therefore not an occasional accident; it is an essential and unremitting element of our cerebral life.”

The inhibition is brought about by the transference of attention from one term to the next in a concatenated series. The attention is always directed toward the ultimate result to be achieved, and the completion of one elementary movement is the signal for attention to move on to the next. If, however, one of the members of the series fails to appear — the remote, auditory image of the vowel, for instance — the activity in the preceding motor circle is unduly prolonged; and if the kinæsthetic sensation from the movement comes to the focus of attention, the muscular contraction may be greatly intensified. In fact, the stammerer may be able to inhibit activity in the motor circle only by relinquishing the attempt to speak.

The foregoing is an attempt to explain in a rather elementary way the rationale of a pseudo-spasm. No attempt has been made to solve the question as to what length the muscular contraction can be automatically continued after it has been voluntarily begun.

¹ *Loc. cit.*, p. 583.

The attempt would lead to an almost interminable discussion concerning theories of different "levels" of attention. The discussion itself would lead nowhere; hence it is best omitted. It is certain that activity in the motor circle is voluntarily initiated, and that it can at any moment be voluntarily discontinued. The whole subjective aspect of the matter can be summarized in the statement that the wrong element gets to the focus of attention. Instead of the verbal image of a word, there is placed at the focus of attention a kinæsthetic sensation of muscular contraction. This abnormal condition intensifies the physical stammering.

But, let it again be emphasized that the pseudo-spasm is purely a secondary manifestation of stammering, and is never the cause of the defect. It is itself *indirectly* induced by the failure of the auditory image; but when the auditory image appears, the pseudo-spasm is at an end.

STAMMERING DUE TO DISTORTION OF THE VERBAL IMAGERY

In some cases the afferent sensations from physical stammering impress themselves upon the memory of the stammerer and distort his verbal imagery. His verbal images of words are then perverted by kinæsthetic images of labial or lingual pressure, or by images of recurring articulation. It can therefore be

said with truth that it is in certain cases more difficult for the stammerer to think some words than it is for him to think others; his difficulty is not necessarily confined to their enunciation. In thinking, he may find that his verbal imagery is at times somewhat constrained by the disappearance of the auditory nucleus; but this imagery may be also encumbered by mental feelings of muscular effort and labored articulation, the consonant appearing in thought much as it appears in speech. It is probable that this articulatory stammering occurs in the mental words of the amnesic stammerer only when the auditory image fails to appear in the mind. It would be the invariable concomitant of a particular mental word if the word invariably occasioned difficulty. However, the stammerer usually has difficulty only under certain conditions; hence he may speak a word fluently more frequently than he stammers upon it, and the sensations from stammering are offset by the more frequent feelings of free articulation.

The replies to the writer's questionnaire show that mental stammering exists in a majority of cases. The correspondents were not asked, however, to differentiate kinæsthetic stammering from auditory amnesia. Either phenomenon is mental stammering, but the average non-psychologist could not be expected to give reliable information concerning the extent to which the conditions exist independently of each other.

The voluntary *imitating* of stammering or stuttering at times effects a perversion of the kinæsthetic and auditory verbal imagery. Since the verbal image is paramount in determining the nature of the spoken word, the simulant then becomes a stammerer in reality, and pays the penalty for his folly by serving as a butt for other witlings. When stammering is induced by imitation, it does not assume the amnesic form; the speech-derangement is occasioned by the distortion of the verbal imagery, and not by failure of "internal hearing." The act of imitating stammering affects the kinæsthetic images more directly, but it probably affects the auditory imagery also, when this happens to be strong. It seems not unlikely that auditory imagery is weak in persons that acquire stammering through voluntary imitation. If the auditory imagery were weak, it would not easily counteract the effect of a slight perversion of the motor memory. On the other hand, it might be argued that if the auditory imagery were strong, it would itself be more easily distorted. However, the auditory imagery is rectified by the acoustic impressions that the stammerer receives when listening to the speech of other persons. His kinæsthetic imagery is probably not corrected by these impressions.

It seems improbable that the mere act of imitating stammering or stuttering should effect organic changes in the brain-cells or fibres. The act of imitating

stuttering might perhaps induce an exalted excitability of the motor centres concerned in speech, and there would then result a species of reflex stuttering. It seems unlikely, however, that such a condition occurs. The cause is more probably psychological. But if even a temporary disturbance in the motor centres were to exist, a perversion of the speech-imagery might ensue, and the impediment would then be established.

Acquired stammering is, in most cases, soon confirmed by the development of fear and by mental confusion resulting from the attempt to avoid difficult words by the use of synonyms. These complicating causes will be discussed in the two succeeding chapters.

Stammering is often acquired by children as the result of *association* with other stammerers. Whatever a child learns, he learns chiefly through imitation. If those around him speak English, he speaks English. If those around him use provincialisms, he uses provincialisms. If those around him stammer, he learns to stammer also. To him stammering may, indeed, appear as a normal mode of speech — or it might if he were able to reflect upon the matter. What really happens is that he hears stammering, and acquires distorted images of speech by the same process that would under other conditions inculcate normal verbal imagery. With his imagery distorted, he must stammer as a consequence. When the

child is associated with both stammerers and normal speakers, he may acquire either natural or abnormal speech. The matter will be determined entirely by the nature of the speech of the persons from whom he acquires the greater part of his instruction or whom he imitates most frequently.

A child's mental imagery may become distorted through association, even after he has acquired a thoroughly normal utterance. If he comes into frequent contact with stammerers at the age of six or seven, his speech may become affected through involuntary imitation. It is the auditory imagery that is first affected; but the kinæsthetic imagery may be indirectly affected by the fact that the auditor takes the words of the speaker, as Bain expresses it, into a "vocal embrace." Ultimately both forms of imagery must become affected, for the child feels his stammering, even if this is originally induced by auditory cues.¹

It follows from the foregoing discussion that one's verbal imagery might become distorted as the result of a speech-disturbance due to purely temporary

¹ Children have, of course, a decided propensity for imitating most of the abnormal conditions that they observe; and they imitate chorea, epilepsy, etc., just as readily as they imitate stammering. It is related of Boerhaave that he once had to contend with an epidemic of epilepsy at the Haarlem Orphan Asylum. He had several pairs of red-hot tongs prepared in a huge brazier in one of the halls. He then called the children together, and told them that he had given orders

causes. After the disappearance of the inducing cause, the impediment might persist as a consequence of the distorted imagery. Stammering would then be due, as it were, to self-imitation, and would continue in spite of the absence of auditory amnesia. When stammering of this kind exists, it probably manifests itself impartially under all conditions. When there is variability in the impediment, the disturbance is complicated by other causes.

There remains now only one of the peculiarities of stammering to be accounted for — the fact that the disturbance usually makes its appearance during childhood. The primary reason for this fact is that the child is more susceptible during his early years to those causes that induce stammering. One of the most prolific causes of stammering is fright. The child is exposed to this cause on account of his inexperience. Objects and occasions that induce fright in early years have no such effect in later life, for the reason that they are better understood.

Infectious fevers are also among the principal cause

for all of them that had epileptic fits in future to be promptly branded. This somewhat questionable procedure apparently terminated the epidemic (see Mosso, "Die Furcht," p. 233). Similar epidemics of imitative stammering seem to occur at times in different communities. To explain this involuntary imitation one must, of course, explain the morbid imitative propensity as well as the mental process by which the imitation proceeds.

of stammering. These fevers generally occur during the earlier years of one's life. Measles, scarlet fever, chicken pox, etc., are usually the illnesses of childhood. It would be safe to say that, with the average person, a majority of the infectious fevers that he suffers during lifetime occur before he is ten years of age.

During the early years of life, when the child is susceptible to the inducing causes of stammering, the mental imagery is in an unstable condition, and is probably for this reason more liable to derangement. Loss of one of the senses during early childhood results in total obliteration of the corresponding mental imagery. This fact shows that the mental images are only superficially enregistered in the cells. It seems, therefore, reasonable to suppose that a relatively slight disturbance may affect the mental imagery. Moreover, if the child inherits weak auditory imagery, he is already predisposed to stammering, and naturally succumbs to the *first* inducing cause.

The infrequent appearance of stammering in adult life is accounted for by the more secure establishment of the kinæsthetic verbal imagery. A minor form of auditory amnesia is less likely to affect oral speech after a person has had twenty or thirty years of practice in the correct use of the speech-organs. This latter circumstance affords an explanation for the fact that functional aphasia occurs more frequently in children during fevers than it does in adults. Greater

clearness of the auditory imagery in girls may account for the fact that these functional disturbances are less common among them than among boys.¹ However, stammering *can* develop at any time in life if the auditory amnesia is sufficiently severe and the patient is an audito-moteur. All that is necessary is that there shall be temporary auditory amnesia without kinæsthetic verbal amnesia. The patient then knows what word he wishes to use, and he knows what the word means. He has a clear kinæsthetic image that permits him to commence its articulation, but no auditory image to enable him to continue. Whenever this condition occurs, stammering results. It is by no means necessary that the inception of stammering be confined to the early years of life; in some cases the speech-disturbance does not begin till after the fortieth year. The reasons, however, have been stated why the impediment generally makes its appearance during childhood.

A remark may be made at this point concerning the acumen of the average stammerer. It is sometimes thought by ignorant persons that the stammerer is not particularly robust in intelligence; but the belief is without foundation. The stammerer is not usually mentally deficient, though in many respects he may appear eccentric. His eccentricity is due solely to his

¹ See Wyllie, "Disorders of Speech," p. 391.

stammering. He frequently uses odd phrases and circumlocutions in order to avoid difficult words, and in this way may appear somewhat *outré* to persons that do not understand his motives. The stammerer sometimes seems to be actuated by vacillating purposes, and in this circumstance may appear erratic. In such cases he has a dual purpose in view; and one purpose — which is not manifest to the casual observer — is to avoid stammering at any cost. He appears erratic merely because his purposes are not fully understood.

The fact that the stammerer is subject to temporary auditory amnesia under particular conditions does not in the least militate against his intelligence. Even if the auditory amnesia were plenary and permanent, the mental faculties would probably remain unimpaired. The mere absence of a particular form of mental imagery does not affect the general intelligence. If evidence were wanting on this point one might cite the case of Hellen Keller. This noted deaf-blind subject is possessed of exceptional intelligence despite the fact that her mind is almost exclusively kinæsthetic and tactual.

So far as intelligence is concerned, stammerers are normal persons. They probably vary between the two extremes just as do persons of normal speech. Frequently stammering is one of the degenerative marks of genius. In his "Man of Genius," Lombroso

cites the following men as stammerers: Aristotle, Æsop, Demosthenes, Alcibiades, Cato of Utica, Virgil, Manzoni, Erasmus, Malherbe, Charles Lamb, Turenne, Erasmus Darwin, Charles Darwin, Moses Mendelssohn, the philosopher; Charles V, Romiti, Cardan, and Tartaglia.

Chervin¹ cites Boissy d'Anglas, Camille Desmoulins, and the artist David as stammerers. Charles Kingsley and Martin Tupper were also stammerers. With so many of the world's greatest geniuses among stammerers, one might almost regard stammering as an accomplishment rather than a defect.

¹ "Bégaiement et autres maladies fonctionnelles de la parole," 3d ed., p. 32.

CHAPTER VIII

MENTAL CONFUSION IN STAMMERING

THE auditory amnesia that we have discussed in the preceding chapter is the proximate cause of stammering. There are, however, two collateral causes — mental confusion and fear — that complicate the disorder. Mental confusion will be the subject of the present chapter.

When the stammerer finds himself suddenly checked in the utterance of a word, he frequently attempts to elude the word by the use of synonyms. This ruse may succeed if an easy synonym is at once forthcoming; but frequently the synonym that suggests itself is no easier than the word that has been rejected. In this case there may ensue a veritable avalanche of thought to which no human speech-organs could give expression. The stammerer is then at a standstill till the original word or a synonym is finally expressed in clear-cut mental imagery.

To take a specific example: The stammerer attempts to say the word *Thursday*, but owing to auditory amnesia he finds himself unable to pronounce it. Immediately he decides to substitute another expres-

sion for the refractory word, and while articulation remains in abeyance, numberless periphrases flash through his mind,—“The day after to-morrow,” “In a couple of days,” “In a few days,” “In two days,” “Perhaps Wednesday or the next day.” If none of these expressions are satisfactory, the stammerer may reconstruct the whole sentence — and even preceding sentences — in order to circumvent the difficulty, or he may come back to his original word and struggle with it till he finally utters it. During this bewilderment the stammerer frequently goes through all sorts of contortions in an attempt to express verbal thoughts that are chaotic to the last degree. The effort may continue where it started with the original word, the tongue pressing vigorously against the teeth; or each expression as it is thought — far too rapidly for utterance — may give rise to some rudimentary change in the disposition of the articulative organs.

It is manifest that no word could possibly be pronounced under mental conditions such as those described. The word *Thursday* cannot be articulated because it is no longer thought. The circumlocutions that suggest themselves flash through the mind so rapidly that no speech-organs could ever express them. The stammerer thinks a whole language in a moment in much the same way as a drowning man recalls half a lifetime in the last few

seconds of consciousness. The verbal image is paramount in determining the nature of the words expressed; hence if no clear-cut verbal image is in the mind, no word can be orally produced. It is no more possible for the speech-organs to produce a word that is not clearly expressed in verbal imagery than it is possible for a gramophone to produce words that are not present on the record. The gramophone reproduces words as they are spoken into it: the speech-organs reproduce words as they are dictated by the verbal imagery. The verbal imagery is absolute.

In cases similar to the one just cited, the *multiple thought* (as we may call the profuse and entangled imagery just described) is a collateral cause of stammering, being itself induced by the amnesia. But in many instances the multiple thought is the sole cause of the immediate disturbance. The stammerer is speaking with apparent ease and fluency, when suddenly there looms up before him a word that has formerly caused difficulty and that he therefore endeavors to avoid. There then occurs the same frantic search for synonyms, the same avalanche of thought, and the same stoppage in speech. But the disturbance is not induced by auditory amnesia: it is occasioned by the fact that the speech-organs cannot express the chaos of the mind.

Here we may take another concrete example: The stammerer wishes to say, "How do you like that picture?" As he utters the word *you* or *like* he fore-

sees disaster at the end of the sentence. Articulate speech is then and there at an end. The word that is being uttered becomes abortive, its mental image being extruded from the mind by the search for synonyms. Innumerable words — *sketch, painting, landscape, masterpiece, canvas, production, performance*, and a dozen others — flash through the mind. If the stammerer finds one that he can articulate, he is able to proceed. He then frequently endeavors to hide his dilemma by recasting the sentence. The question then becomes "What do you think of that painting?" "Does that landscape suit your taste?" "Is that canvas to your liking?" etc. If the stammerer is little embarrassed, he may give no evidence of his predicament. He pauses quietly, selects the desired word, and continues when he has the thought satisfactorily framed.

There is often a tangle of *visual* images participating in the multiple thought. These may be visual images of words, or visual images of objects. The stammerer is in a shop, let us say, where he has to make a number of purchases. He attempts to ask for a particular article, but stammers hopelessly when he endeavors to name it. Thereupon he decides to ask for one of the other articles first, and to essay the refractory word at a more propitious moment. The chances are that the utmost mental confusion will result. Visual images of the different objects and mental images of

words rush through the mind in perfect chaos. During this bewilderment, stammering must of course continue; and it is probable that the speaker will not be understood when he at last gives utterance to some half-smothered expression.

We may consider another case in which visual images are present to add to the bewilderment. The stammerer is asked the way to a certain street or building, and there are different routes that he may describe to the inquirer. The stammerer starts to give directions for a particular route, but finds after a few sentences that he is hopelessly stranded on the name of a street he wishes to mention. It is not essential, however, that this particular street be referred to, for an alternative route may be described. The stammerer then vacillates between the decision to proceed with the original directions and the decision to describe an alternative route; and there occurs in his mind a tumult of thought in which verbal images and visual images of streets and buildings are tumbled together in hopeless confusion. Meanwhile the physical stammering probably finds expression in a motor circle. The stammering terminates only when clear verbal images arise to mediate the expression of clear oral speech.

Frequently, during stammering, verbal thought is inhibited rather than confounded. The mind is then a blank, or the entire field of consciousness is engaged

by a visual sensation or a visual image. The stammerer is asked the name of a particular book, let us suppose, but is afraid of certain words that occur in the title. He makes no attempt to reply, but stands mentally transfixed, gazing at any object that happens to be before him. Or it may happen that a visual image gets to the focus of attention, and the stammerer then stares helplessly at a mental picture of the book or a visual image of its title. For a minute or more he makes no attempt to answer the question, but deliberately suppresses the auditory-motor images of the requisite words. Usually the mind is more prolific, and the stammerer is able to resort to synonyms. It might seem that synonyms would be unavailing in the present case; but this is not necessarily true. Often the stammerer would not hesitate to pervert the title in quoting it (believing that any irregularities will be attributed to error), or to improvise a title for himself, or to plead entire ignorance in the matter.

In many cases of stammering the impediment is in large part due to confusion or inhibition of thought. It then frequently happens that the impediment disappears almost entirely in reading and reciting. Under these circumstances the stammerer is not obliged to select his words; consequently mental confusion is eliminated. Most stammerers speak with less difficulty when alone. The greater fluency is in

this case largely attributable to the fact that the speaker does not try to avoid stammering, and consequently does not become bewildered in his effort to avoid difficult words.

Another possible explanation for the stammerer's occasional fluency in reading has already been suggested. The visual impressions may arouse the refractory auditory images by association, or they may directly arouse the kinæsthetic images. It will be remembered that the ability to read aloud is not at all uncommon among aphasic patients, — even when they are quite unable to speak spontaneously. In such cases the explanation is the summation of stimuli or the arousal of refractory images by sensations with which they are associated. This same explanation would apply to the case of the stammerer. It does not, however, account for the stammerer's occasional ability to recite, so we must conclude that the elimination of bewilderment is also an important factor.

With a great many stammerers there is no mitigation of the impediment in reading and reciting. In some cases, indeed, the disturbance may be aggravated. The exacerbation is produced by the stammerer's fear and confusion. The increased fear is due to the fact that the stammerer finds himself the centre of attention, and to the fact that he anticipates difficulty with particular words. The confusion is occasioned by the stammerer's exploring

in advance in search of difficulty. His attention is not concentrated upon the words he is actually pronouncing: it is divided between these words and those that he knows are to follow. The stammerer, moreover, will often substitute words even in reading, and will interpolate phrases of his own. "Any port in a storm" seems to be the motto. This attempt to paraphrase difficult passages leads, of course, to entangled thought that cannot be expressed.

The enhancement or mitigation of the impediment in reading and reciting is determined chiefly by the stammerer's mental attitude. When attention is concentrated upon the words that are being spoken, stammering is limited to the amnesic form. (The amnesia may, of course, be augmented to some extent by fear.) When the stammerer endeavors to struggle against the inevitable by paraphrasing passages and meeting trouble in the distance, the impediment is indirectly induced by mental confusion, as well as being directly induced by auditory amnesia.

A too rapid production of verbal thought has been considered by many investigators to be the proximate cause of stammering. But the stoppage of speech that they have considered is usually due to mental chaos rather than to a rapid production of clearly thought verbal images. These two conditions, mental chaos and a slightly too rapid production of verbal

images, must be differentiated. When the verbal images succeed one another too rapidly for utterance, cluttering, and not a *stoppage* of speech, results. Wyllie refers to the former defect in the following words :

"When the words crowd upon each other so much as to interfere with their distinct articulation, the condition has sometimes been called 'Cluttering.'" ¹

Wyllie then quotes Dr. Clouston's description of a case of this kind :

"Although 'articulation is normal when slowly performed, the moment ordinary speech begins, the mental coördination is lost, and we have a torrent of half-articulated words, following each other like peas running out of a spout.'" ²

This condition does not often occur with persons of normal intelligence. It is evident that the will to speak is present, but that the speech-mechanism is unequal to the task imposed upon it. When *stammering* occurs as the result of multiple thought, it is *not* willed that the rapidly thought verbal images shall be enunciated. The stammerer's purpose is primarily to *select* a word to which he believes he can give utterance; and the mental synonyms that occur in thought are as a rule not even incipiently articulated. The images pass so rapidly through the mind that they could not be expressed even if

¹ "Disorders of Speech," p. 139.

² *Loc. cit.*, p. 140.

they occurred in pure kinæsthetic form. Quite frequently these verbal images appear in visual form, and hence have no direct effect upon the speech-organs. Multiple thought is mental chaos, and it is not the same mental condition that gives rise to cluttering.

A condition of speechlessness frequently occurs in normal speakers as the result of mental confusion. It is often the concomitant of emotional excitement; and the person is speechless with fear, anger, or dismay. Speechlessness occurs either because there is a failure of verbal thought or because the verbal thought is too tumultuous and chaotic to find articulate expression. This emotional condition frequently gives rise to temporary "stammering" in children. The child attempts to describe something that has deeply impressed him. He gasps and gesticulates, but says nothing. This inhibition is produced by a tangle of thought that probably subsists for the most part in visual terms. The condition is not induced by amnesia, and the child is able to speak with fluency if he is compelled to calm himself before making the attempt.

The tendency to think in visual terms is not in itself a cause of stammering. There are numberless persons that think almost exclusively in visual images, but they are not necessarily troubled with disorders of speech. The practice of thinking in visual terms may be a serious bar to fluency in speech, for the habitual visualizer does not always readily recall the

words necessary for the expression of thought. This paucity of verbal images gives rise, however, merely to hesitancy in speech and not to genuine stammering.

It is well for the stammerer to bear in mind that any articulate sounds produced by the speech-organs are, in general, reproductions of the verbal imagery.¹ The articulative mechanism does not reproduce *all* that is passing in the mind, but whatever *is* produced is mentally initiated. When the stammerer prolongs a consonant in speech, he prolongs it also in thought. When he repeats a word, syllable, or consonant in speech, he repeats it in thought. The prolongation of the consonant is due to the amnesia. But the repetition — especially of syllables and words — is usually purely voluntary. The stammerer makes the repetition in order to overcome the resistance, as it were, by the sheer momentum of the articulation. But the speech reflects the thought, and the stammerer will not always find that this mental repetition affords the best method of procedure.

It is possible that even cluttering may in some cases represent the verbal imagery, and that the cluttering is subjective as well as objective. A species of cluttering sometimes occurs with the stammerer even when he knows clearly what words he wishes to utter. Under the influence of fear the words are produced (or, more

¹ This remark does not apply to some extraneous sounds that may accompany physical stammering.

accurately, *smothered*) so rapidly that it seems as though they must be initiated by a sort of generic verbal concept instead of by a series of verbal images clearly expressed in the mind. The stammerer gasps out the first few words of the sentence and is then hopelessly checked by amnesia or by an inability to decide between repeating the sentence and continuing from the point he has already reached. No general statement can be made as to whether this cluttering is mental or physical. In some cases the speech may exactly represent the verbal imagery; in others the verbal imagery may be clear, though it cannot be clearly expressed because it is too rapidly produced and because fear paralyzes the musculature.

CHAPTER IX

FEAR AND AUTO-SUGGESTION

FEAR is perhaps the most important of the mediate causes of stammering. The stammerer's fear is somewhat similar to stage-fright. It takes the form of an all-consuming dread that effectively deprives the speaker of muscular control. This fear is difficult for the non-stammerer to understand. It is not merely the fear of incurring ridicule, or the fear of making oneself ridiculous; it is rather the fear of "travailing with unborn thoughts." It is one of the subjective aspects of stammering that only the stammerer himself can comprehend.

Schulthess has compared the stammerer's fear to hydrophobia, and he named the condition "Phonophobia," or "Lalophobia." Wyneken, having regard to the stammerer's fear of particular words, denominated him a "speech-doubter" (*Sprachzweifler*).¹ He believed the stammering to be due largely to a wavering of the will during speech; this vacillation being caused in its turn by the stammerer's lack of confidence in his own speech-organs. Strictly speak-

¹ "Ueber das Stottern und dessen Heilung," p. 20.

ing, this latter condition is not fear; it is inhibition of the will due to auto-suggestion. Both fear and auto-suggestion are potent factors in the indirect production of stammering. Denhardt, in his "Stottern eine Psychose," maintains the position that these factors are the sole causes of the defect. His arguments are interesting and well worth following.

Denhardt attempts first of all to refute the current theory that stammering is due to a failure of voice. He declares that he has occasionally seen stammerers that were unable to articulate isolated consonants entirely unattached to vocal sound.¹ The phenomenon that Denhardt describes would refute the "failure of the voice" theory, but it is itself readily explained by the theory adduced in this monograph. When a person articulates the consonant *b* (for instance) in the physiological alphabet, he produces the vowel *en souffle*, or thinks it in auditory imagery and suppresses its oral production. If the auditory image fails, the speaker may appear to stammer even on a simple articulatory movement.

The auditory image attached to the physiological consonant is not necessarily an image of the vowel-sound that is associated with the consonant in the common alphabet. It may be an image of the short

¹ That is, a consonant in the *physiological alphabet*, in which *b*, for instance, is a mere explosive movement of the lips, and not the word *be*, as we know it in the ordinary alphabet.

u (ü) that generally follows an explosive physiological consonant. The failure of this image would account for the stammering. If one were to stammer on a simple movement of the lips that is kinæsthetically initiated, he would stammer at the end of words, and would stammer in smoking, etc.

Denhardt then attempts to refute the "failure of voice" theory by showing that stammering sometimes occurs when the speaker is making the transition from the vowel to the consonant. He says:¹

"On the other hand, there are not lacking stammerers that experience difficulty in making the transition with the speech-organs from the position taken by the vowel to that required for the consonant; consequently they repeat the vowel once or twice in the form of a short 'afterstroke' before they are able to seize upon the consonant that completes the syllable. As a result one hears something like *Ka-ap* and *La-and*, instead of *Kap* and *Land*."

It is somewhat strange that Denhardt should interpret these symptoms as betokening difficulty in making the transition from the vowel to the consonant. The symptoms are unquestionably due to respiratory disturbances, one of the chief features of physical stammering. The break in the vowel is due to a sudden inhibition of the expiratory current: the weakening of the air-column permits the glottis to close, consequently there is a brief interruption in

¹ "Das Stottern eine Psychose," p. 28.

vocalization. The stoppage of the expiratory current is due to a fluttering of the diaphragm, — one of the natural concomitants of emotion.

There is another possible explanation for this "catch" in the vowel that Denhardt describes. The stammerer may vocalize from purely kinæsthetic cues, but so long as he cannot recall the auditory image he is unable to produce the vowel-color. It will be remembered that this imperfect enunciation of the vowel has been described by Hunt and other writers. (See pp. 190-192.) It often takes the form of an inhibition of the second element of a diphthong. As a rule, the difficulty is directly due to defects of the auditory imagery; but it is never due to the fact that the stammerer experiences difficulty in articulating the final consonant.

These arguments of Denhardt are mentioned chiefly because they are based upon facts that seem, if only superficially examined, to be at variance with the theory advanced in this monograph. They are the only heterodox facts that have been encountered, and it has seemed advisable to lose no time in disposing of them.

Denhardt refutes, more or less successfully, the current theory that stammering is due to a failure of voice. He then defends the theory that stammering is induced solely by fear and auto-suggestion :

"If one asks the stammerer why he is unable to speak fluently, he will in most cases receive the reply, 'It is because of fear.' . . .

If one goes a step further and endeavors to assure himself of the nature of this fear and its foundation, he will regularly find that it is based upon the stammerer's belief that he is unable to speak." ¹

"It is quite immaterial for the influence of the disturbing belief whether or not it has any foundation in fact. But the belief has with the stammerer no basis in reality, for under certain circumstances he is able to speak with consummate ease." ²

"We have to deal with a delusion that has driven its roots so deeply into the consciousness of the stammerer that even if it should leave him — as it may for days, weeks, or months together — it invariably returns; frequently, too, with increased intensity." ³

One of Denhardt's chief arguments is the existence of analogous phobias. He cites the case of a flute-player that experienced the same difficulty in playing as he did in speaking:

"When he had to play a solo with orchestral accompaniment, he felt himself incapable of beginning at the proper instant. For hours before, he was haunted by fear of the dreaded moment; and the fear increased as the time approached. In his room he could perform without hesitation; but in the concert hall, a few hours later, this had become an impossibility." ⁴

"I have seen stammering in piano-playing on several occasions," remarks the same writer. He then recounts the experience of a young lady:

¹ *Loc. cit.*, p. 144.

² *Loc. cit.*, p. 145.

³ *Loc. cit.*, p. 144.

⁴ *Loc. cit.*, p. 178.

"The eye would explore hastily in advance of the hands, and would discover difficulties that at once induced fear of failure. The nearer she approached them, the greater became her fear of the supposed obstacles; and at the critical moment the disturbing influence of the fear effectually prevented the proper execution of the necessary movements."¹

Denhardt then gives an account of a subject that was unable to write if some one were watching over his shoulder:

"Whenever an *R* had to be followed by a vowel, there arose in his mind the thought that he could not freely execute the necessary writing-movements. Like the stammerer, he performed all kinds of superfluous and purposeless movements. Finally he accomplished his task by separating the vowel from the initial consonant by a long dash (*R—abe*). When he knew himself to be unobserved he experienced no difficulty with any combination, not excluding *Ra*, *Ro*, etc."²

The author then cites two cases in which difficulty in swallowing was due to delusional belief, — to a loss of confidence in the ability of the physical organs to perform their normal functions. He says of one subject:

"Upon my own initiative I brought him to the belief that he had incurred the difficulty as the result of excessive cigarette smoking. Upon his relinquishing the cigarettes, the trouble disappeared. 'Now comes the stammering. Although I have not smoked a cigarette since the improvement in my condition, I have only to recall my former troubles in order to

¹ *Loc. cit.*, pp. 178-179.

² *Loc. cit.*, p. 179.

induce difficulties in swallowing. I then incur a relapse for a day.”¹

“The next case is of a little different nature. A gentleman was accustomed for several years to taking all liquids from a spoon, believing himself to be unable to drink. In drinking from the spoon, however, he executed all the movements of deglutition in a perfectly normal manner — proof that he had lost nothing of this faculty with which he was merely afraid to intrust himself. The use of the spoon was of value only in so far as it exerted a favorable influence upon his imagination. The effects of the delusion were counteracted by the confident belief that the use of the spoon would remove difficulties that might otherwise appear. One day, after a long and trying march, and while tormented by thirst, he rapidly drank a glass of beer without reflecting. As the result of this incident he regained his lost confidence in the organs of deglutition; and this confidence did not thereafter desert him.”²

Denhardt concludes the recital with an account of a man that had lost confidence in his ability to use his hands in the presence of other people. While using a soup-spoon, for instance, his hands would tremble so severely that he became practically powerless. He was able to master this weakness only by beginning the meal with a powerful stimulant.

These morbid fears or obsessions are common enough in pathology, and cases similar to the foregoing might be cited indefinitely. The abnormal fears are known as phobias. Many of them have been endowed with a special name. *Erythrophobia* is

¹ *Loc. cit.*, p. 180.

² *Loc. cit.*, p. 181.

the morbid fear of blushing; *klithrophobia*, or *klaus-trophobia*, is the fear that seizes one when alone in a room; *agoraphobia* is the fear of crossing open thoroughfares. When the agoraphobic patient is compelled to cross an open square or traverse a wide thoroughfare or bridge,—

“There ensues, according to Westphal’s characteristic description, an inordinate fear—a veritable death-terror—accompanied by general trembling, an oppression of the chest, palpitation of the heart, and sensations of chills or of a warm wave mounting to the head. One breaks into a perspiration, and stands as though helplessly paralyzed. There is weakness of the limbs, and often sparks dance before the eyes. There is humming in the ears; there is nausea and complete confusion.”¹

St. Phar refers to these morbid fears in the following words:²

“Pathological fear makes its appearance in the most diverse forms, and not merely as agoraphobia. One person cannot travel by train, another cannot ride in an electric car, or in any vehicle at all, without experiencing these conditions of fear. One patient is attacked by this abnormal dread during thunder-storms; another when he finds himself in the midst of a crowd, or when he is in a theatre, a church, or in a room above the ground floor, or in a tunnel. Others experience terror when the weather is a little more than ordinarily warm or cold. Abnormal fears are particularly likely to appear under those circumstances in which normal persons experience normal fear, as in accidents, earthquakes, fire, flood, and danger of any kind that induces emotional disturbances and threatens

¹ Eulenburg, *Die Woche*, March 17, 1906.

² “Angst,” pp. 4-5.

life and property. In short, fear is extremely multifarious. It can appear in connection with any conceivable circumstance; and it reappears usually under those circumstances that were responsible for its origin. It varies with the same patient, assuming sometimes a more malignant and sometimes a milder form."

In these phobias two conditions must be differentiated. There is the simple fear, as such; that is, the mere emotional disturbance: and there is the emotion accompanied by an obsession or delusional belief. In the fear of thunder-storms, only the emotional disturbance is present. In agoraphobia there is abnormal fear and also the *belief* in one's inability to cross the thoroughfare. When both the fear and the delusion are present, they of course react upon each other.

The phobias are either due to some unfortunate experience accompanied by intense emotion, or they are simple atavisms. In the latter case they are reverberations of racial experience; *i.e.* they are instinctive fears. In either case the emotion is aroused by association. When the fear is *acquired*, the association is due to the experience of the individual. When the fear is instinctive, the association is due to racial experience. This matter will be discussed subsequently at greater length.

After this slight amplification we return to the subject of stammering as caused by phobia and delusional belief. Denhardt cites the morbid fears already mentioned; then continues:

"Supported by the analogies mentioned, we can safely state that no objection need be feared to the theory already promulgated, — that stammering is a psychosis having its origin in some more or less casual incident in the history of the patient. This psychosis is based upon a delusion, an absolutely unfounded belief that there exists an impediment to the free use of speech. This delusion wreaks havoc with the different innervations requisite for oral speech. Neither the expression 'fear' (Schranck) nor the term 'doubt' (Wyneken) is applicable to this delusion, for when the delusion arises there is not doubt, but subjective certainty; and this certainty is not always accompanied by such feelings of malaise (*Unlustgefühle*) as would justify one in speaking of 'lalophobia' or 'speech-fear.' These feelings of malaise are secondary, being induced by the delusion, — which naturally enough gives rise to painful experiences. One might regard stammering as one of the manifold forms of hypochondria if the symptoms of the latter affection were delusions concerning bodily disabilities, rather than 'fear and anxiety for the body itself.'"¹

The chief flaw in Denhardt's theory is that it does not account for the inception of the speech-disturbance. Denhardt imagines that stammering begins by some sort of accident—an accidental stumbling in speech — and that introspection then confirms the defect. (This same introspection and fear is made to account for stammering when it is induced by imitation and association.) The initial trouble having arisen, the development of the malady is easily explained :

¹ *Loc. cit.*, pp. 181-182.

“Should the revived memory-picture possess sufficient clearness and intensity to awaken feelings of anxiety and fear, and should its fatal influence not be neutralized by reason or by an unwavering faith in one’s own faculties, then there steps in for a second time bewilderment and delay to wreak havoc with the movements that should give oral expression to thought. The incident will be repeated, and with every repetition the disturbing influences find an easier victory. The anxiety rising from the recollection has shown itself to be well founded. Any dubiety as to its foundation, which might at first have appeared, is silenced by the seemingly incontrovertible evidence of fact. Forthwith there disappears anxiety — care lest there should recur those unhappy disturbances with which the malady began — and in its stead there prevails the subjective certainty that the stammerer no longer has unimpeded use of speech. Thus there is established the delusional belief that any attempt to speak is frustrated by an actual impediment; though this impediment has in truth no existence outside the imagination of the now fully developed stammerer. This belief, with the concomitant feelings of malaise (at times weaker and at times stronger) is thenceforth the invariable cause of stammering.”¹

The delusional belief, according to the author, assumes all kinds of illogical forms :

“For instance, some believe that they can speak better during warm than during cold weather; while others hold the opposite view. In a way, both are right, for it cannot be denied that whenever the conviction of this relation has become seated in the mind of the stammerer, the circumstances will to an extent accommodate themselves to the belief. Whoever looks for the mitigation of his trouble in warmer weather will, with the advent of such weather, in reality feel freer and more

¹ *Loc. cit.*, p. 147.

resolute, and will consequently stammer less. This result is not to be attributed to the weather as such, but solely to the stammerer's belief that the weather confers upon him a power that he did not formerly possess."¹

According to our author, a superstition prevails that the intensity of the stammerer's impediment is in some way correlated with the different phases of the moon. The waning moon is supposed to mitigate the impediment, and the crescent moon to aggravate it. This belief influences the stammering:

"He that firmly believes in this lunar influence will find his observations to some extent in accord with his theory; but that the moon is not accountable for the correlation is clearly shown by the following incident. During the course of a conversation a stammerer once informed me of this relation between the severity of speech-disorders and the phases of the moon. I at once insisted that there must be some mistake: he had the relations reversed. And in truth this same gentleman astonished me soon after with the information that I was right, and that the waning moon was accompanied by an enhancement of the impediment. The belief aroused by my positive assertion was sufficiently powerful to influence the mind of the stammerer in the direction suggested, so that he was able to discover variations in his own impediment corresponding to the changing phases of the moon."²

Denhardt expresses a cogent truth in the theory that stammering is due to fear and auto-suggestion. The theory, however, expresses but a partial truth, for fear and auto-suggestion merely aggravate the

¹ *Loc. cit.*, p. 86.

² *Loc. cit.*, p. 87.

impediment—they do not cause it. They are themselves the *effects* of the disorder, and later they react upon it as mediate causes. The *immediate* cause, as we have seen, is usually transient auditory amnesia. Denhardt himself regards the fear as an indirect rather than a direct cause. The condition directly responsible for the stammering he considers to be indecision, or a wavering of will, this being caused in its turn by the stammerer's lack of confidence in his own ability to control the speech-organs. Denhardt says of this vacillation of the will:

"An examination of the mental processes during stammering shows that the disturbance takes the form of a struggle between two opposing forces, — the will, which endeavors to translate the thought into spoken words, and the belief in one's inability to accomplish what is intended. The former impels forward, and the latter backward: the will to speak initiates a movement, but in the same instant fear obstructs it. All the characteristic phenomena of stammering emanate from this conflict and from the visible efforts of the stammerer to procure the victory for the former at all costs. In the end, the will to speak invariably prevails, and compels the enunciation of the word that was at first checked or impeded by the stammerer's fatal belief in his own disability. Often this conquest is made only after continued struggle and bewildering effort."¹

This indecision and constant checking of the fiat has been mentioned in the preceding chapter. It is an immediate cause of stammering, but it is itself a

¹ *Loc. cit.*, pp. 176-177.

secondary manifestation. There would be no wavering of the will if an impediment to speech did not first exist.

One of the chief faults in Denhardt's theory is that it takes no account of the origin of speech-disturbances. Denhardt carefully classifies the inducing causes of stammering, giving them as mechanical causes (a fall or a blow, for instance), mental shock, and illness; but he does not show how these causes operate. After the cause has appeared, the patient simply stammers. However, Denhardt testifies to the aphasic nature of stammering in the following paragraph:¹

"One of my patients, when five or six years old, experienced an unlucky fall on the head, which was accompanied by much loss of blood. As a consequence he remained speechless for a year. After this interval the speech returned, but it was distorted by severe stammering, which had not left the patient in his thirty-first year."

By the recital of such incidents and by his classification of the inducing causes of stammering, Denhardt may fairly be said to compass the refutation of his own theory.

As already stated, the theory supposes that the impediment develops accidentally, and that it is confirmed by the subject's fear of its recurrence and by his morbid introspection. The most cogent argument against this developmental theory is that 87 per cent

¹ *Loc. cit.*, p. 104.

of stammerers are, as children, already subject to the impediment before they enter school. This means that the impediment develops before the age of five or six. At this age the child is not addicted to reflective self-analysis. He is not an introspectionist; he is an animal leading a sensory-motor life. The child does not reflect upon his own idiosyncrasies; and at an early age his peculiarities of speech pass unnoticed. Certainly the child is not capable of morbid self-analysis such as induces phobia. The child stammers because of auditory amnesia. The morbid fear develops later in life.

Denhardt endeavors to anticipate these objections. He asserts that the child's reflections are all the more deleterious because they are unreasoning, and because the fear is based upon ignorance. His chief difficulty, though, is to show that the fear exists. In endeavoring to establish the latter fact he unfortunately argues by analogy.

"One gives a little child a sour apple [he says]. After the child has bitten it and experienced the unpleasant taste, he lets the apple fall or throws it away. Let one repeat the experiment after some time, and he will see how the child turns away with evident aversion and rejects the apple that is offered him."¹

Manifestly there is no parallel between these two cases; and any conclusion that may be derived from

¹ *Loc. cit.*, p. 153.

the one has no application whatever to the other. In the case of the apple we are dealing with a simple association between a visual and a gustatory impression. In the case of stammering we are dealing with an association between speech-hesitancy and an emotion that has not yet been shown to exist. The argument presupposes the existence in order to arrive at the association. But even if the naïve child were to experience emotion and chagrin when stammering, he would not be likely to develop lalophobia through a process of morbid introspection. Denhardt attributes undue precocity to the child. If the child could develop stammering through morbid anxiety after some accidental hesitancy in speech, then there would exist a far greater number of stammerers; for every child falters at an early age when acquiring command of language, and every child is therefore a potential stammerer.

It is evident that Denhardt's theory fails conspicuously in two respects: it does not account for the origin of the stammering that is supposed to give rise to the psychosis or phobia, and it does not account for the fact that stammering develops in the entirely naïve period of life. The fear and auto-suggestion develop at a later period, and they exist thereafter as mediate causes. But the potency of these causes cannot be easily overestimated. Denhardt has not emphasized these secondary causes unduly. He is in error merely

in supposing them to be the sole causes that exist. His book shows an excellent attempt to throw aside the futile theories of the elocutionists. It can safely be said that the reader would be well repaid for a perusal of this interesting work.

A great many writers hold to the theory expressed by Denhardt, and several of them expressed the theory before him. Wyneken states his opinion as follows :¹

“Were I to attempt an explanation of the case, I should say that the will is more or less restrained — so far as its control over the speech-muscles is concerned — and that this occurs through fear. The stammerer is a speech-doubter. When he attempts a difficult word, his will is partially lamed by doubt, — which one can in a way regard as an independent will inimical to the true will. The muscles controlling respiration, phonation, and articulation do not know — if I may so express myself — which master to obey; therefore they do not properly perform their functions, and stammering naturally ensues. It is just as though one were to attempt a leap, and find himself seized with doubt at the very moment that he springs. He is too late to prevent the leap, but does not jump with confidence, and hence does not accomplish what he intended.”

Werner says of fear :²

“Why is it that the stutterer, when alone, has no trouble, but the very moment some one enters his presence he becomes helpless? The answer comes with irresistible force, — because of fear.”

¹ “Ueber das Stottern und dessen Heilung,” pp. 20-21.

² *Werner's Voice Magazine*, Vol. XI, pp. 86-87.

According to Frank :¹

"Stammering is a fear-neurosis, which is caused in neurotic children by fright during the earliest years of life."

Stekel says :²

"One of the severest forms of pathological fear is found in stammering, — the fear of speech. Originally it is the fear of betraying some secret during speech. Later the fear becomes transferred to the act of speaking itself."

Stekel introduces the inevitable "sexuelle Aetio-logie" of the Freud school. At present his theories of causality need scarcely be discussed.³ So far as they relate to stammering they are sufficiently ridiculous to carry their own refutation.

We shall now consider how these secondary causes, fear and auto-suggestion, come to effect disturbances in speech. We shall consider first the influence of fear unattended by auto-suggestion, or belief in one's own disabilities ; and then the effect of auto-suggestion itself so far as it can be studied as an isolated factor. Auto-suggestion, however, when it is a suggestion of failure, is rarely unaccompanied by fear.

¹ "Die Psychanalyse," p. 15.

² "Nervöse Angstzustände und ihre Behandlung," p. 231.

³ The theories of the psychoanalytic school are discussed at some length in Vol. II, Chap. VII.

THE DIRECT EFFECTS OF FEAR

Fear operates by paralyzing the musculature. It inhibits even the grosser muscular movements. Many persons cannot walk naturally upon a platform when they know themselves to be the target for a battery of eyes. Self-consciousness and fear deprive them of muscular control, and there exists a condition similar to agoraphobia. Westphal's description of the patient suffering from agoraphobia (p. 298) is merely the description of a person seized with extreme fear. The person's helplessness is due to the fact that he is mentally transfixed.

"People are frequently run over by carriages, cars, or trains on account of the sudden great fright caused. The one idea of danger reverberates in the mind like a sudden powerful clap of thunder, confusing and stunning all other ideas; the mind is brought into a contracted cataleptic condition, and the field of consciousness is narrowed down to that one idea, to a single point."¹

Animals are often thrown by fright into a cataleptic condition. This may occur also with human beings. The cataleptic condition is physical, but it is accompanied by a condition of "mental catalepsy," as Sidis figuratively expresses it. Denhardt records the case of a boy that would frequently faint when his stammering became severe. The fainting may not have

¹ Sidis, "The Psychology of Suggestion," p. 60.

been wholly due to fear, but there can be no doubt that it was due in large part to this cause.

Fear exerts its greatest influence upon the accessory muscles. The articulative organs or fingers may be rendered powerless when the larger muscles of the body are practically unaffected. Fear causes one to falter while playing the piano, and it interferes with articulation in speech. The most fluent speakers may be rendered impotent by stage-fright.

Fear induces cerebral congestion, and it is probably this condition that inhibits muscular control. It will be remembered that Mosso's experiments showed that there was a far greater flow of blood to the brain during fear than during ordinary mental activity:

"The brain-pulse became six or seven times greater than before; the blood-vessels expanded, and the brain swelled and beat with such vigor that my colleagues stared with astonishment at the photogram of the tracings."¹

Mosso relates an interesting incident apropos of the afflux of blood to the brain, and the consequent shrinkage of the body, during fear. A friend informed him that upon the occasion of a sudden fright a ring once dropped from his finger, — though this ring ordinarily fitted so closely that considerable effort was required to remove it. The incident shows that fear must be accompanied by a prodigious flow

¹ "Die Furcht," p. 73.

of blood to the brain. During fright this afflux of blood to the brain is often so great that it causes death through rupture of the cerebral vessels.

Cerebral hyperæmia probably effects an obfuscation of the mental imagery. This subjective condition would account for the exacerbation of stammering during fear, and for speechlessness during stage-fright. The direct cause is amnesia; the inducing cause is fear. It is not surprising that fear should induce transitory disabilities in speech, for fear is one of the most prolific causes of permanent stammering and is one of the causes of aphasia. The more intense emotion induces permanent stammering or aphasia probably through rupture or excessive distension of the finer cortical vessels. The weaker emotion may induce temporary stammering through cerebral hyperæmia that leaves no injury to the brain.

Fear seems to be particularly inimical to the auditory imagery, — or perhaps it is that the obscuration of the auditory imagery manifests itself in more direct form. Persons afflicted with stage-fright often stutter and articulate without producing a word. It seems as though they are able to recall the grosser articulative movements requisite for the enunciation of the words, but unable to recall the auditory images necessary for their completion. In the stammerer, the auditory imagery is more readily affected than

imagery of other forms. The auditory images are, as it were, more readily extinguishable. It is, of course, this vulnerability of the acoustic imagery that makes the person a stammerer.

Pure fear—even when it is not speech-fear—is likely to produce mental chaos or bewilderment, and thus to interfere with the execution of speech. “Presence of mind” under conditions of emotional

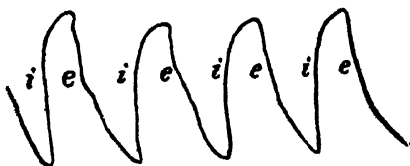


FIG. 7.—“Ordinary, quiet breathing; *i*, inspiration; *e*, expiration”
(after David Greene).

excitement is a rather rare attribute. “Absence of mind,” or chaos of mind, is the more common condition.

Fear may aggravate physical stammering by inducing respiratory disturbances. The disturbances usually take the form of a “fluttering” of the diaphragm. That the irregular action of the diaphragm is due to emotion rather than to voluntary physical stammering is shown by the fact that it is present *before* the stammerer begins to speak. Often it commences as soon as the stammerer is addressed. Introspection likewise discloses the fact that the abnormal respiration is due to fear or excitement. The

condition is often induced by the mere thought of speaking, when no occasion for speech actually exists.

Many writers have investigated these respiratory disturbances with the pneumograph. Liebmann says on the matter:¹

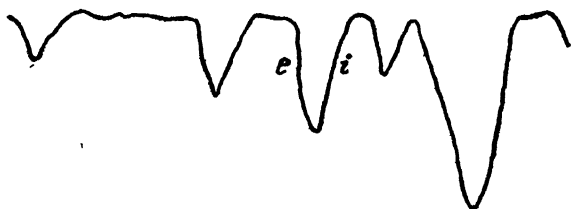


FIG. 8. — "Irregular breathing caused by mental agitation while being asked a question" (after David Greene).

"Gutzmann and I have studied the stammerer's abnormal respiration by means of Marey's pneumograph. We ascertained that the respiration of most patients becomes irregular just before speech begins, and that all kinds of abnormal inspiratory and expiratory movements occur during speech itself. During normal speech there occurs a short, deep inspiration, followed by a long and gradual expiration."²

Figures 7 and 8 show the respiratory curves obtained by another investigator.³ The irregularities in the second curve are caused by emotion. It is evident

¹ "Vorlesungen über Sprachstörungen," 1. Heft, p. 7.

² See also Gutzmann und Liebmann, "Pneumographische Untersuchungen über die Atmung der Stotternden." (*Wien. Med. Bl.*, 1895.)

³ David Greene, "The Preponderance of Male Stammerers over Females." (*New York Medical Journal*, April 13, 1901.)

that such abnormalities of respiration as those recorded must inevitably reveal themselves in speech.

AUTO-SUGGESTION

We shall now study the direct effects of suggestion, bearing in mind the fact that fear is usually present as a complicating factor, and that pure auto-suggestion rarely acts alone.

Stammering is sometimes induced by external suggestion. It seems probable that fear is absent in such cases. In the following words Sidis describes the manner in which he induced stammering and partial agraphia in one of his subjects:¹

"I then tried on Mr. W. another experiment. 'Pronounce "Boston."' — 'Boston,' and he said it easily enough. 'And now again.' I stretched out my hand and made it perfectly rigid. 'P-p-p-oston!' he ejaculated with great difficulty. 'Again.' I made my hand stiffer, and pointed it almost directly in his face. No sound. 'Don't look at me,' he said at last, 'and I shall be able to say it.'

"'Well, then,' I said, 'try the following sentence: "Peter Piper picked a peck of pickled peppers."' He began to say it, but when he came to 'peck of' I raised my hand and stiffened it. 'P-p-pe-ec-k' came from his lips; he began to stammer and could not continue.

"'Well, then,' I said, 'let me see if you are able to pronounce your own name.' He pronounced it. 'Try again.' I stiffened my hand and again the same result — he was unable to pronounce his own name. . . .

¹ "The Psychology of Suggestion," pp. 181 ff.

“‘Just try to write your name,’ I said. He wrote it. ‘Again.’ He wrote it once more. I asked him to write slowly; meanwhile I raised my hand, stiffened it, kept it before his very eyes. The results were now extremely interesting. His hand became cataleptic; he could not manage it. In a loud voice he began to give suggestions to himself. ‘*I am able to write my name; I can write my name; I will and shall write it; yes, I can; I can write my name;*’ etc. Each time as he caught sight of my raised hand and listened to the torrent of suggestions I poured forth his hand became slightly cataleptic and the letters became broken, but each time he repeated his suggestions the hand went on writing. . . . [Finally] my suggestions were completely disregarded.”

Stammering and agraphia were produced in this case by the inhibition of muscular control. The sight of the stiffened hand aroused in the subject mental feelings of stiffness in his own muscles, and these kinæsthetic images were expressed in muscular contraction. There probably resulted also an inhibition of the fiat, due to the subject’s belief in his inability to speak or write.

Auto-suggestion is undoubtedly the direct cause of stammering in some cases.¹ It is the cause of stammering when the subject has difficulty with only *one* particular word but never with its homonyms or derivatives. Thus the subject may stammer on *petroleum* but not on *petroleuse*,² on *two*, but not on

¹ A number of writers have attributed stammering to auto-suggestion. See Moll, “Hypnotism”; Quackenbos, “Hypnotism in Mental and Moral Culture,” etc.

² See Denhardt, “Das Stottern eine Psychose,” p. 147.

too or *to*. In such cases, stammering is directly induced by auto-suggestion; but in the ordinary case of stammering — *i.e.* in amnesic stammering — auto-suggestion is operative only as a contributory or secondary cause.

Auto-suggestion acts ordinarily by inhibiting volition. The subject firmly believes in his inability to perform a certain act, and therefore hesitates to attempt it. Even after beginning, he is repeatedly deterred by the conviction of his own impotence. As we have already seen, Denhardt and Wyneken regard this wavering of the will as the direct cause of stammering. It is one of the principal causes. It renders the stammerer constantly irresolute, and frequently prevents him from observing a direct and progressive procedure in the expression of even the simplest thought. This fact is fittingly illustrated by a couple of incidents that Denhardt records:

A young man wished to purchase a theatre-ticket for the parquet, but fearing that he might stammer, he began by asking for "ein Billet zum ersten Rang." Then a moment later he feigned a change of mind, and asked in the most casual manner for "ein Parkett-billet."¹

Denhardt then relates an incident in his own experience:²

¹ "Das Stottern eine Psychose," p. 46.

² *Loc. cit.*, pp. 46-47.

"This reminds me of a stratagem that often rendered me good service, when, as a boy, I had to purchase cigars for my father. Upon entering the shop I walked to the open case, which contained an assortment of cigars of which I knew the prices perfectly well. In affected ignorance I pointed to and inquired about a particular cigar that I had no intention of buying. I repeated these tactics with one or two others till I thought the propitious moment had arrived; then I requested the shop-girl to give me the particular brand of cigars that I had been commissioned to buy."

Most stammerers could cite incidents of a like nature in their own experience. These facts illustrate the point already made, — that the stammerer often fails to observe a direct and progressive manner of thought. There is endless vacillation of the will, and the verbal image that should instigate oral speech is constantly inhibited. The inhibition occurs, too, after the stammerer has begun to speak, and in this case it is directly responsible for the stammering.

Auto-suggestion can operate in another way. When the stammerer expects to encounter difficulty with a particular word, he attends to his stammering rather than to his speech. Mental images of the expected stammering — labial effort, contraction of the lingual muscles, etc. — then get to the focus of attention, and displace the normal verbal images. These unnatural mental images, of course, express themselves in muscular movements, and stammering ensues.

Auto-suggestion thus induces stammering through

the inhibition or the displacement of the normal verbal image. It is probable that inhibition is itself brought about only by the diversion of attention to an obsessing image. The subject offers a rich field for investigation.

Some stammerers find that they are able to speak when they feel "compelled" to do so by the very urgency of a situation. There are stammerers, for instance, that speak well in public. Martin Tupper never stammered when reading or reciting. Charles Kingsley spoke well from the pulpit, but stammered badly in conversation. The writer knows several ministers that have this experience. One stammerer of the writer's acquaintance is a successful amateur actor; another is a talented orator and debater. A probable reason for the stammerer's fluency under coercive conditions is that he is seized with a determination to give unimpeded expression to thought, and that he therefore ceases to vacillate, and reintegrates the verbal images in a consecutive and orderly manner. It is doubtful whether this is the sole reason for the stammerer's fluency. It is probable that the very urgency of the situation really assists the stammerer in overcoming his amnesia. This phenomenon would not be surprising, for we find that aphasic patients often break the bonds of silence under the pressure of intense emotion. Unfortu-

nately, the stammerer's speech often suffers in the reaction, and a complete collapse follows the brief subjugation of the impediment.

Stammerers that are able to suppress the impediment by sheer force of will are certainly in the minority. The majority of stammerers experience fear that is proportionate to the exigency of the circumstances, and stammering is proportionate to the fear. This is a somewhat perverse condition of affairs, but it is nevertheless the condition that usually prevails.

Denhardt believes that the stammerer's fluency or difficulty in speech under particular circumstances is due entirely to the memory of the initial success or failure. If the stammerer succeeds the first time he talks from a platform, he is confident thereafter, and consequently speaks with fluency. If he stammers the first time, he fears further attempt; hence stammers on future occasions:

"The memory of success or failure has the greatest significance in the life of the stammerer. Should he by chance speak well at the beginning of the day, then the outlook for the rest of the day is more favorable: the converse also is true. If he stammers first on a *p*, he acquires a special fear of this letter, and consequently has trouble with words that begin with it. The effect of memory varies with the circumstances, and it is extraordinarily diverse in duration. The effect may endure for hours, weeks, or months."¹

¹ Denhardt, "Das Stottern eine Psychose," p. 84.

EMOTIONAL ASSOCIATION

The effect of the initial success or failure is explained by *emotional association*. The fear or assurance that originally accompanied a particular circumstance is recalled by the recurrence of the circumstance itself. The emotion then impedes or facilitates speech. This emotional association explains the idiosyncratic differences among stammerers themselves.

Particular words, as well as particular circumstances, acquire associations that render them effective mischief-makers. The word seems to acquire the emotion of fear as one of the elements of the concept. As soon as the word appears on the horizon of consciousness, there occurs a deluge of emotion that buries all verbal imagery by its very intensity. Mental chaos and loss of muscular control then render the stammerer impotent.

The fear of these particular words often takes the form of a veritable phobia. The stammerer picks out difficult words more or less consciously in silent thought, and even frames his own verbal thoughts to avoid them. He selects difficult words as he listens to the conversation of another person, and looks for his enemies while reading. This is *lalo-phobia* in an unmitigated form.

Emotional association is one of the most potent

influences in human life. An emotion that has accompanied a particular circumstance tends in a remarkable way to be aroused by the recurrence of the circumstance itself.¹ The emotion seems to be not merely *aroused* by the mental image or impression, but seems rather to become an integral part of the concept.² One surveys the scene of a former accident *with* horror. One regards some detestable creature *with* loathing, hatred, or fear. One regards a friend *with* affection or esteem. The particular circumstances that engendered these feelings may be entirely forgotten. The emotion simply attaches itself to the object and clings to it thereafter irrespective of the presence or absence of intelligent cognitive memory.

Of all emotions, fear forms the most powerful associations. The reason for this is evident. During the early history of the race, a strong emotional association of this nature would be a biological necessity. The individual possessed of strong associations of fear would be likely to survive. On the other hand, the individual that was devoid of this

¹ The converse of this principle is expressed in the proposition that our thoughts are consistent with our moods.

² Many authorities hold that there is no "affective memory"; i.e. that there are no *mental images* of emotional experiences. They believe that the emotions are revived in *actuality* and not in memory. But even under these circumstances one could regard the awakened emotion as one of the elements of the concept.

emotional association would soon be eliminated. Fear has thus been self-perpetuating; and strong fear-associations have come to be a racial heritage. Many of these associations are ready-made: the fear is instinctive, and occurs anterior to all experience. "Secondary," or acquired, fears are established by the experience of the individual; but they may remain as quasi-instinctive fears after the incidents that occasioned them are forgotten.

"Cases of strange and insurmountable fear or antipathy have been noticed in some celebrated men: Scaliger was seized with nervous trembling at the sight of the water-cress, Bacon fainted during eclipses, Bayle at the sound of running water, James I at the sight of a naked sword."¹

Ribot supposes these fears to be due to the forgotten experiences of early childhood. Such instances demonstrate the persistence of fear-associations. Many of the phobias cited in the earlier part of the chapter are manifestly due to individual experience, and often to experiences that have been totally forgotten.

Instinctive emotions, due to racial experience, are common in both human beings and the lower animals. The chick fears the hawk, though it has had no encounter with the depredator. Most animals show instinctive fear of their natural enemies. Gratilot gave a very young puppy a fragment of wolf's skin

¹ Ribot, "The Psychology of the Emotions," p. 216.

so worn that it resembled parchment. When the animal smelled it, he was seized with intense fear.¹ In this case fear was aroused by a simple olfactory stimulus. Instinctive fears are forever outcropping in the human being. We see racial reverberations in the fear of the dark and of water, in the dread of high places and of solitude, in the fear of reptiles, insects, fur, etc.

"Children who have been carefully guarded from all ghost-stories are nevertheless terrified and cry if led into a dark place, especially if sounds are made there. Even an adult can easily observe that an uncomfortable timidity steals over him in a lonely wood at night, although he may have the fixed conviction that not the slightest danger is near."²

These instinctive fears, of course, vary greatly in different persons. In a few persons, most of the instinctive fears are present. In others, only the more common and "natural" fears are in evidence. All degrees of variation are found between the two extremes.

Fear as an emotion and an instinct has practically outlived its usefulness. (This is true, at least, of the emotion in its intenser forms.) Fear has been an important factor in the evolution of the race, but civilized races have now reached a point of develop-

¹ Ribot, "The Psychology of the Emotions," p. 7.

² Schneider, "Der Menschliche Wille," p. 224; quoted by James, "Principles of Psychology," Vol. II, p. 418.

ment where instinctive fears and fear-associations have little function to perform. Fear has become an execrable heritage, for in most cases its function is perverted, and the emotion is aroused by an entirely inappropriate stimulus. As an instinct, fear is almost an atavism; as an emotion aroused by associational bonds, it is usually a curse. Fear makes it impossible for one to accomplish the very thing in which he dreads to fail.

Ribot holds that any fear is pathological when it becomes hurtful rather than useful. Féré's criterion of the morbid is the undue intensity of the emotion, its unreasonable prolongation, and insufficiency of the cause. According to these tests, most instinctive and acquired fears are pathological when the emotion reaches any considerable degree. The stammerer's fear is unquestionably pathological. In this case all criteria are superfluous.

So much for instinctive fears and fear-associations.

THE NATURE OF FEAR

We shall consider now the intrinsic nature of fear and of emotion in general. Emotion is usually regarded as a purely mental phenomenon — as something that one feels actually *within the mind*. The emotion is thought to be aroused by its appropriate object, and the physical disturbances to be aroused in their turn by the emotion. The James-Lange

theory,¹ a theory that is now widely accepted by psychologists, exactly reverses this sequence. It supposes that the physical disturbances occur reflexly when the stimulus appears, and that the emotion is nothing more nor less than the feeling of these physical disturbances. That this is the more logical order of the events should be evident from our previous discussion of inherited instincts. An organism cannot inherit knowledge: it is not aware, during its first experience, of the nature of the impending danger from which it flees. When it flees, it merely reacts to an emotional stimulus. The presence of the emotion can be explained only on the ground that it consists in the feeling of reflex physical disturbances. James explains his theory concerning the sensory nature of emotion as follows: ²

“Our natural way of thinking about these coarser emotions is that the mental perception of some fact excites the mental affection called the emotion, and that this latter state of mind gives rise to the bodily expression. My theory, on the contrary, is that *the bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur, is the emotion*. Common-sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, are angry and strike. The hypoth-

¹ For a complete discussion of this theory see C. Lange, “Ueber Gemüthsbewegungen,” Leipzig, 1887; and James, “Principles of Psychology,” Chap. XXV.

² “Principles of Psychology,” Vol. II, pp. 449-450.

esis here to be defended says that this order of sequence is incorrect, that the one mental state is not immediately induced by the other, that the bodily manifestation must first be interposed between, and that the more rational statement is that we feel sorry because we cry, angry because we strike, afraid because we tremble, and not that we cry, strike, or tremble, because we are sorry, angry, or fearful, as the case may be. Without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colorless, destitute of emotional warmth. We might then see the bear, and judge it best to run, receive the insult and deem it right to strike, but we should not actually *feel* afraid or angry."

That emotion is not a purely mental phenomenon is evident from the fact that it is entirely independent of cognition. Fear persists in spite of one's positive belief in the non-existence of danger. Looking down from the top of a monument, one trembles despite the fact that he *knows* he cannot fall. He is behind an iron railing, and could not fall if he wished; but this knowledge does not inhibit the reflex visceral changes, and consequently does not inhibit fear. One trembles as a lion springs forward in his cage. One knows perfectly well that there is no danger, and may even feel ashamed at his own apparent timidity; yet he cannot suppress the reaction or the corporeal changes that give rise to fear.

The bodily changes occur reflexly, and they are but little under the control of the will. For this reason intelligent reflection has little effect upon the

feelings. The emotions of sorrow and anxiety that one experiences in a theatre are not dispelled by the thought that the fair maiden is paid so much a week for being killed by the villain. One's sympathy with the maiden and indignation at the villain are none the less sincere. But the emotions cannot be controlled even when things more serious are at stake. A surgeon would scarcely undertake to operate on a near and dear relative, for he knows that his fear and anxiety cannot be subdued, and that his emotions — try as he may to suppress them — will render him impotent at a time when life and death depend upon his self-control.

If an emotion were purely cognitive, there would be no reason why it should ever cease. An insult or a wrong is no less an insult or a wrong because it was suffered a year ago. The loss of a friend is no less a bereavement because it occurred in the past. Yet such affairs of the past are usually viewed with considerable *sang-froid*. The knowledge or cognition, however, has not changed. The physical reactions have merely worn themselves out.¹

Introspection shows that emotion is nothing more than the feeling of changes proceeding within the body:

“If one notices the uncomfortable mood brought about by strained expectation, anxiety before a public address, vexa-

¹ The intensity of the memory-images would have to be considered in a more thorough analysis of such cases.

tion at an unmerited affront, etc., one finds that the suffering part of it concentrates itself principally in the chest, and that it consists in a soreness, hardly to be called pain, felt in the middle of the breast and due to an unpleasant resistance which is offered to the movements of inspiration and sets a limit to their extent. The insufficiency of the diaphragm is obtruded upon consciousness, and we try by the aid of the external voluntary chest muscles to draw a deeper breath.”¹

“These physical changes giving rise to emotion are usually so numerous and subtle that, as James says, “the entire organism may be called a sounding-board, which every change of consciousness, however slight, makes reverberate.” The feeling of these changes alone constitutes the emotion. If the feelings are subtracted, no emotional coloring remains.

“What kind of an emotion of fear would be left if the feeling neither of the quickened heart-beats nor of shallow breathing, neither of the trembling lips nor of weakened limbs, neither of goose-flesh nor of visceral stirrings were present, it is quite impossible for me to think. Can one fancy the state of rage and picture no ebullition in the chest, no flushing of the face, no dilation of the nostrils, no clenching of the teeth, no impulse to vigorous action, but in their stead limp muscles, calm breathing, and a placid face?”²

It is manifest that if the physical feelings were absent, the emotion would no longer exist. The emotion of sorrow often has its nucleus in a “lump

¹ James, “Principles of Psychology,” Vol. II, p. 445 (quoting Henle, “Natural History of the Sigh”).

² James, *loc. cit.*, p. 452.

in the throat." A slight fear, as one slips on the stairs, is often nothing more than a momentary "chill" in the small of the back. Cutaneous shivering often constitutes the chief part of the emotion that one feels when listening to poetry or music. A spinal chill occurs when one listens to the grating of two sharp steel edges. The chill is emotional in coloring; yet it is manifest that no emotion of a mental nature is present.

The physical concomitants of emotion are often very conspicuous. A severe fright may bleach the hair, deprive one of consciousness, of sight, of speech, or of the use of one or more of the limbs.¹ A milder fright will cure hiccups or drunkenness, — likewise through the operation of corporeal changes. Blushing may be "so intense as to cause a rash afterward; and, in rare cases, it may amount almost to vesication."²

Emotion is due not merely to the grosser physical changes within the body; but also to chemical changes in the tissues and to activity in the various glands. These chemical changes, as well as the grosser physical changes, can often be artificially induced. Drugs may transmute the whole nature of the psychical mood. The imbibing of a little alcohol

¹ In all but the first case, through the mediation of cerebral changes.

² G. Stanley Hall, "A Study of Fears" (*Amer. Jour. of Psych.*, January, 1897).

will change one's entire outlook upon the world. Imbibing to excess inhibits the outlook entirely. Hashish produces exaltation, and ipecacuanha induces depression or fear.

Bodily diseases affect the moods. A bad case of dyspepsia is apt to be as uncomfortable for the immediate associates of the patient as it is for the patient himself. Diabetes is often accompanied by depression, and phthisis by joyful spirits. These emotions or moods are physical in origin: they are due to chemical changes within the system. Morbid emotional conditions are often due to disease. Melancholy may result from a blow upon the head; cheerfulness returns when an operation relieves an abnormal pressure on the brain.

"In every asylum we find examples of absolutely unmotivated fear, anger, melancholy, or conceit; and others of an equally unmotivated apathy, which persists in spite of the best of outward reasons why it should give way."¹

The thyroid gland, situated at the base of the larynx, is in some inscrutable way intimately connected with the emotional life of the human being. Diseases of the thyroid gland are usually accompanied by pronounced emotional disturbances. Of goitre, an affection of this particular gland, Havelock Ellis says:²

¹ James, *loc. cit.*, p. 459.

² "Man and Woman," 4th ed., p. 268.

"The appearance of the patient suffering from this disease — the staring protruded eyes, the breathlessness and rapid heart, etc. — suggests a person suffering from terror, and it is remarkable that fright has often formed the starting point of the disease."

Graves' disease is a somewhat similar disorder; and the patient suffering from it presents all the symptoms of extreme terror. The following is Dr. Mackenzie's description of the malady:¹

"Fright, intense grief, and other profound emotional disturbances have been recognized as causes of the pathological condition, but I do not think that sufficient attention has been paid to the very close connection between the chronic symptoms of Graves' disease and the more immediate effects of terror. The descriptions given by Darwin and Sir Charles Bell of the condition of man in intense fear might almost have been written in regard to one of the patients we have been considering. The heart beats quickly and violently, so that it palpitates or knocks against the ribs. There is trembling of all the muscles of the body. The eyes start forward, and the uncovered and protruding eyeballs are fixed on the object of terror. The surface breaks out into a cold clammy sweat. The intestines are affected. The skin is flushed over the face and neck down to the clavicles. The hair stands erect. 'Of all emotions, fear notoriously is the most apt to induce trembling.' The symptoms of terror are common to man and the lower animals. There are one or two of the minor symptoms of Graves' disease whose independent occurrence under the influence of

¹ *Lancet*, September, 1890. (Quoted by Ellis, "Man and Woman," 4th ed., p. 269.)

emotion is well known. These are pigmentary changes in the skin and hair, falling out of the hair, and epistaxis."

Patients suffering from dyspepsia often manifest the same symptoms. The physical changes being present, they experience the emotion of fear; and this fear is in no way different from the fear that would be aroused by the perception of some fear-inducing object. The following is a description of the purely physical fear of the dyspeptic:

"All physicians who have been much engaged in general practice have seen cases of dyspepsia in which constant low spirits and occasional attacks of terror rendered the patient's condition pitiable in the extreme. I have observed these cases often and have watched them closely, and I have never seen greater suffering of any kind than I have witnessed during these attacks. . . . Thus, a man is suffering from what we call nervous dyspepsia. Some day, we will suppose in the middle of the afternoon, without any warning or visible cause, one of these attacks of terror comes on. The first thing the man feels is great but vague discomfort. Then he notices that his heart is beating much too violently. At the same time shocks or flashes as of electrical discharges, so violent as to be almost painful, pass one after another through his body and limbs. Then in a few minutes he falls into a condition of the most intense fear. He is not afraid of anything; he is simply afraid. His mind is perfectly clear. He looks for a cause of his wretched condition, but sees none. Presently his terror is such that he trembles violently and utters low moans; his body is damp with perspiration; his mouth is perfectly dry; and at this stage there are no tears in his eyes, though his suffering is in-

tense. When the climax of the attack is reached and passed, there is a copious flow of tears, or else a mental condition in which the person weeps upon the least provocation. At this stage a large quantity of pale urine is passed. Then the heart's action becomes again normal, and the attack passes off."¹

The existence of these purely physiological fears supplies the last link in our chain of evidence. It should now be clear that emotion is nothing more than the feeling of bodily changes that occur in response to specific stimuli. With the origin of these changes we are not concerned. The reader that is interested in the matter is referred to special works on the psychology of the emotions.²

In the next chapter we shall consider briefly the possibility of controlling the physical reactions that give rise to fear.

¹ R. M. Bucke, "Man's Moral Nature," p. 97. (Quoted by James, "Principles of Psychology," Vol. II, p. 460.)

² Darwin, "The Origin of the Emotions"; Bain, "The Emotions and the Will"; Ribot, "The Psychology of the Emotions"; James, "The Principles of Psychology"; Spencer, "The Principles of Psychology"; etc.

CHAPTER X

COROLLARIES

IN the foregoing chapters we have studied the causes of stammering. In this chapter we have to consider briefly in what measure these causes may be obviated. The primary cause of stammering, it has been shown, is transient auditory amnesia. The secondary, or auxiliary, causes are bewilderment; perversion of the verbal imagery; auto-suggestion giving rise to inhibition of the will; and, finally, fear. The use of physical effort in speech might be regarded as another of the mediate causes of stammering; but the physical stammering to which it gives rise is really an extraneous symptom. It must be differentiated from the abnormal speech that reflects the verbal imagery, and must receive its special form of treatment.

It is at once evident that the secondary causes of stammering are themselves *effects* of the primary cause. If the primary cause, auditory amnesia, could be removed, the secondary causes, fear, wavering of the will, etc., would quickly vanish. The removal of the amnesia is, then, of chief importance. However,

there can be little doubt that the secondary causes are chiefly responsible for stammering in many cases. When elocutionary methods effect a cure, as they do in a few instances, there can be little *amnesia* involved. One must conclude that in such cases the secondary causes of stammering (the *effects* of the primary disturbance) persist after the auditory *amnesia* has disappeared.

The stammerer must diagnose his own case, and determine to what extent each of the several causes conduces to the disturbance of his speech. If he finds that little *amnesia* is present, he may be sure that his defect of speech can be readily overcome.

We shall now consider the various secondary causes of stammering, taking them in the order of convenience. Afterward, we shall discuss the subject of auditory *amnesia*, and the question of obviating it. We begin with the discussion of fear.

FEAR

Fear, we have seen, is nothing more than the feeling of certain physical changes going on within the body. If these bodily changes could be prevented, the emotion would not arise. Unfortunately, most of the bodily organs in which these changes occur are not under the direct control of the will. One may change the facial expression, relax the tightened muscles, and alter the respiration; but one cannot

directly control the subtle activity of the internal organs. Within certain limits, the internal changes are subject to the influence of physical association; but the changes cannot be directly inhibited, hence the emotion cannot be directly controlled.

James advocates the practice of simulating an opposite emotion. The argument is that the voluntary expression of the emotion induces, to some extent, the involuntary physical changes, and that the voluntary and involuntary changes are then felt as a form of the emotion simulated. It is evident that the undesirable emotion must be neutralized if the assumed emotion is felt even to a slight degree, for the two contrary emotions cannot coexist. James's remarks on the subject are as follows:¹

"Refuse to express a passion, and it dies. Count ten before venting your anger, and its occasion seems ridiculous. Whistling to keep up courage is no mere figure of speech. On the other hand, sit all day in a moping posture, sigh, and reply to everything with a dismal voice, and your melancholy lingers. There is no more valuable precept in moral education than this, as all who have experience know: if we wish to conquer undesirable emotional tendencies in ourselves, we must assiduously, and in the first instance cold-bloodedly, go through the *outward movements* of those contrary dispositions which we prefer to cultivate. The reward of persistence will infallibly come, in the fading out of the sullenness or depression, and the advent of real cheerfulness and kindness in their stead. Smooth the

¹ "Principles of Psychology," Vol. II, p. 463.

brow, brighten the eye, contract the dorsal rather than the ventral aspect of the frame, and speak in a major key, pass the genial compliment, and your heart must be frigid indeed if it does not gradually thaw!"

Emotions can sometimes be counteracted in a measure by deliberate analysis of them. Fear may lose its prestige when it is viewed as an agglomeration of bodily sensations. But the efficacy of self-analysis is determined entirely by the temperament. With some subjects it may be deleterious rather than beneficial.

The stammerer must, as far as possible, annihilate fear-associations — or, better, prevent their forming — by deliberately ignoring failures and unpleasant incidents. From the very nature of the human mind, the act of disregarding such incidents must tend, by weakening the associations, to exclude recollection of them. Brooding over failures has the opposite effect. It tends to imprint the incidents more deeply on the mind, and to endow them with an emotional coloring that later exerts a pernicious influence.

The nature of the emotional life is largely determined by the physical condition. A person in excellent health is little subject to baseless fears. On the other hand, the person that is "run down" and "unstrung" is liable to all sorts of nervous and emotional disturbances. Lowered vitality affects the stammerer in a number of ways. It not only

enhances his fear, but it aggravates the amnesia. The amnesia and fear then aggravate each other.

Knowledge is the greatest counteractive of fear. "By long consent, knowledge is power; still more emphatically and specially, knowledge is composure" (Bain). When the stammerer knows the cause of his speech-disturbance, he feels less fear at its advent. The impediment is more readily surmounted, and even if it cannot be immediately overcome, it is at least deprived of some of its terrors.

AUTO-SUGGESTION

If fear and auto-suggestion were the sole causes of stammering, hypnotism would afford the natural remedy for speech-defects.¹ Many reliable hypnotists affirm that they have cured stammering by means of suggestion, but the more reliable among them admit that they have generally failed.

Hypnotism is used as an adjunct in some of the "stammering-schools" of Europe, more particularly in those of Germany. The hypnotists, however, treat merely the fear and lack of confidence of the stammerer; thus they miss the primary cause of

¹ Hypnotism is still regarded by a good many people as a species of black magic. This deplorable ignorance is largely imputable to the sensational press and the freebooters of the vaudeville. An exposition on hypnotism is beyond the scope of this work. The reader wishing information on hypnotism is directed to monographs dealing with the subject.

the speech-disturbance. The treatment would be effectual if it were possible to intensify the auditory imagery and to inhibit the amnesia by means of post-hypnotic suggestion. This matter deserves thorough investigation.¹

During the past few years psychoanalysis has been employed in Europe in the treatment of stammering, — the stammering being regarded as a fear-neurosis. The method of treatment seems to be no more efficacious than the old elocutionary methods. Various “psychological” methods are vaunted by stammering-schools in Germany, England, Switzerland, and Russia; but these “methods” are generally little more than advertising attractions, the principal “system” being usually an elocutionary one. The psychological methods may or may not possess inherent virtues; but they are usually applied by incompetents (men that are neither physicians nor psychologists); hence the success derived is generally nugatory.

Counter auto-suggestion is advocated by many persons engaged in treating stammering. The stammerer is taught to combat his lack of confidence with the counter-suggestions of “I can and I will,” etc. The “I can and will” business is practically the whole stock in trade of many illiterate “speech specialists.” The trouble is that under their malev-

¹ The writer would be pleased to hear from investigators the results of any researches they may undertake in this field.

olent treatment, the stammerer can't and doesn't. Mere brute-will accomplishes nothing, for the stammerer does not know what he is trying to accomplish. He tries merely to speak, without knowing anything of the psychological process. When the mental imagery fails, the sheer "I will" leads to physical effort. Counter-suggestion, when applied in a general way, is egregious nonsense. It may be efficacious in counteracting fear and "delusional beliefs," but its efficacy in any particular case will be determined entirely by the temperament of the subject. A person of emotional temperament might find counter-suggestion extremely beneficial; but one possessed of a cool, analytical mind would doubtless find it futile. The former would do well to meet a difficult situation with suggestions of his perfect confidence; the latter would better refuse to think of the circumstance, — deliberately turning his thoughts to other things and relying upon an intelligent comprehension of the psychological speech-processes to tide him over difficulties.¹

MULTIPLE THOUGHT

There is no indirect method of attacking multiple thought. The stammerer must simply realize that the verbal imagery is absolute in determining the

¹ The psychological systems currently employed in treating stammering are discussed in Vol. II, Chap. VII.

nature of speech. If the verbal images are not expressed clearly in thought, and expressed in orderly consecution, the oral words cannot under any possible circumstances be clearly spoken. The stammerer is always tempted to substitute synonyms for difficult words. The expedient permits him to enjoy a transient immunity from his impediment. Ultimately, of course, the use of synonyms aggravates the disturbance by increasing mental confusion. The stammerer must on many occasions choose between two evils. He may speak the words that rise first in his mind, and stammer whenever difficulty occurs; or he may re-frame his sentence whenever he encounters an obstacle. The latter course affords temporary immunity; and, since it is the path of least resistance, it is the one that the stammerer will frequently follow. The former, however, is the only possible course for the stammerer to pursue if he is finally to overcome his difficulty.

When the impediment is severe, the stammerer can readily overcome the tendency to employ synonyms. He finds most words difficult; consequently it is an easy matter for him to treat them impartially. When the disturbance is slight, the stammerer is tempted to conceal his impediment by resorting to synonyms. It is the stammerer of the latter type that will have the greatest difficulty in restraining multiple thought.

It is not advisable for the average stammerer to frame each sentence before speaking it, though he is frequently advised to do so. This method of thinking the words first and speaking them afterward is entirely unnatural. The average stammerer would be tempted to pick and choose his words while framing the sentence, and confusion would ensue even in this preliminary thought. Further, the appearance of a difficult word in the sentence would augment the speaker's fear and thus increase his predicament. It is better for the stammerer to speak each word as it rises in his mind and to treat difficult and easy words impartially. If he is greatly tempted to replace difficult words by synonyms, he might find it desirable (if he visualizes readily) to hold a visual image of the refractory word before his mind. This image would focus the attention, and to some extent counteract the tendency to substitute.

DISTORTION OF IMAGERY

Distorted verbal imagery is easily corrected if the stammerer can find *any* circumstance under which he can speak with fluency. Even if the stammerer cannot speak with fluency when alone, he can usually enunciate freely when speaking in unison with another person, or when repeating the words that another person has just uttered. Sufficient practice in natural speech under these condi-

tions, or under any conditions, will restore the verbal imagery.

Stammering that has been induced by imitation or association is usually complicated by such secondary causes as inhibitive auto-suggestion and fear. These causes must, of course, be combated as well as the distortion of the imagery. The stammerer must determine for himself to what extent unnatural imagery is responsible for unnatural speech. If he speaks fluently when alone, it is certain that the distortion of the imagery is not solely responsible for the speech-disturbance, — unless, of course, he finds that distorted images are reintegrated only in an unfavorable environment. Such a condition of affairs seems, however, highly improbable. In any case, distorted imagery is easily rectified; and when the impediment is due solely to this cause, it can be readily overcome.

PHYSICAL STAMMERING

Physical stammering is easily eradicated by elocutionary methods. In most cases it can be eliminated in two or three weeks by careful training. By removing the secondary symptoms of amnesia, elocutionary training often seems to effect a miraculous improvement within a brief space of time; but the improvement seldom progresses to a cure, for the amnesia remains unalleviated.

The intractability of a case is proportional to the

severity of the *amnesia* and not to the severity of the physical stammering. Bell has remarked that¹—

“A case of apparently slight impediment is frequently more tedious and difficult to cure than one of the most boisterous and convulsive aspect.”²

The boisterous and convulsive aspect results from physical stammering, and it can be readily eliminated. It bears no necessary relation to the severity of the *amnesia*. The *amnesia* may be severe and no physical stammering be present. Liebmann says of a particular case of passive stammering:³

“One can see plainly that the patient wishes to answer; but she cannot do so, either aloud or in a whisper. One can detect no articulatory movements, and the pneumograph shows a normal respiration-curve. Only after some time does the patient begin to speak; and then she does so in a fluent and normal manner. The patient says that she knows the answer, but is simply unable to say it.”⁴

In cases of this nature there is no physical stammering, and elocutionary methods would be practically unavailing.

Of the elocutionary systems it may be said that most of them will rectify the stammerer's errors of

¹ “Principles of Speech,” 5th ed., p. 236.

² See also H. Gutzmann, “Sprachheilkunde,” 2d ed., pp. 446–447.

³ “Vorlesungen über Sprachstörungen,” 1. Heft, p. 27.

⁴ See also p. 209 of this volume for Gutzmann's statement, “There are stammerers that never stumble in speech, but that stammer, nevertheless.”

respiration, phonation, and articulation; and that most of them are therefore good so far as they go. The trouble is that they do not go far enough: they treat only the symptoms, but not the cause of the speech-defect.

A detailed discussion of the merits and demerits of the various systems is, of course, beyond the scope of the present chapter: the subject has been reserved for the succeeding volume. A few general remarks at this point may, however, be pertinent.

It may be stated that the time-beating system — which has its widest vogue in America — is directly pernicious, since it distorts the stammerer's verbal imagery.¹

Many systems viciously overemphasize articulation, and thus tend to confirm an erroneous attitude that most stammerers have toward speech. The average stammerer gives the greater part of his attention to sensations from the speech-organs, and very little attention to the verbal image by which the word is initiated. The afferent stimuli, however, do not facilitate utterance; rather they divert attention from the point on which it should be focussed. Hence any system that overemphasizes articulation is nocuous in such respect.

Under some elocutionary systems the pupil is taught to note the words on which he stammers, and to practise these words together with various alliterations

¹ This remark applies to any system based upon rhythm.

that introduce the "difficult consonants." The practice is pernicious, since it establishes fear-associations. The stammerer acquires fear of certain words and letters; and when these words or letters recur, fear augments his difficulty. The practice develops lalophobia, but does absolutely no good to compensate for the evil it engenders.

PURE STAMMERING

It is evident that after the stammerer has overcome physical stammering, distortion of the imagery, multiple thought, fear, and inhibitive auto-suggestion — all these being secondary causes or manifestations of the defect — he has still the auditory amnesia to contend with. At best he has reduced his complex stammering to pure stammering: he has reduced the disturbance to its lowest terms. But in many cases no severe stammering will remain, and the slight remnant of the defect may cause little inconvenience. The auditory amnesia is often induced by the secondary causes, and so may disappear when these causes are removed. However, this is not invariably the case; hence we have to consider the question of obviating the amnesia itself.

Two questions naturally suggest themselves: First — Can the refractory auditory image be goaded into activity by artificial means? Secondly — Can the auditory image be strengthened so that it will be

less likely to vanish? ¹ These two questions must be considered at length.

There seems to be no doubt that auditory sensations facilitate the redintegration of auditory images. Paulhan remarks that the sound of a train or a waterfall makes it easier for him to recall tunes in auditory memory.² Illusions of hearing are common, — undoubtedly more common than those of sight. This fact shows that auditory images are easily awakened by more or less irrelevant auditory impressions. In certain cases one is absolutely dependent upon auditory sensations for the arousal of auditory images. For instance, there are many people with weak auditory imagery that can whistle a tune audibly, though they cannot whistle in *mental imagery*. It is perfectly clear that they do not recall the tune in kinæsthetic imagery; hence the auditory images of the various notes must be aroused by the acoustic sensations from the notes that precede them.

¹ There can, of course, be no assumption of function by the opposite hemisphere of the brain. The defect in the auditory centre appears to be usually functional rather than organic, and the stammerer is not incapacitated for silent thought. Hence, even in young children no transference of function takes place. Any lesion that is sufficiently severe to occasion transference of function is sufficiently severe to induce aphasia rather than stammering. Transference of function, in cases of stammering, is therefore out of the question.

² "Le langage intérieur" (*Revue philosophique*, janvier, 1866, p. 34). Cited by Ballet, "Le langage intérieur," 2d ed., p. 22.

Most stammerers find that they can speak better in the presence of sounds that the average person would consider distracting. The noise of a train, the clatter of vehicles, or the sound of voices seems to exert a beneficial influence upon the stammerer's speech. The sound of human voices is particularly salutary. The average stammerer finds that he can speak with unusual fluency if a number of persons happen to be speaking within hearing-distance. The explanation for this fluency is that the auditory sensations facilitate the arousal of the auditory images requisite for speech. It seems as though activity in the cells subserving the sensations renders the contiguous cells more excitable.

Lunn says :¹

"It has often been remarked that deaf people hear best in a noise, as in railway travelling."

Here, again, we must suppose that the extraneous sounds assist in overcoming the inertia of the auditory cells.

The fact that an acoustic sensation may awaken the refractory auditory image affords a cogent reason why the stammerer should commence the articulation of a word even if its auditory image is not at once forthcoming. The initial consonant can be produced by kinæsthetic cues ; and the sound of this consonant

¹ *The Voice*, Vol. V, p. 133.

will often arouse the indolent auditory image — or intensify it if it should be too weak to prompt the enunciation of a word. Further, the kinæsthetic sensation tends to arouse the auditory image by association. When the association is itself inadequate, the sound-impression may often turn the balance.

There is another cogent reason why the stammerer should commence the articulation of a refractory word. The concentration of attention upon the word eliminates multiple thought and vacillation of the will — elements that might otherwise exert a disturbing influence. The procedure advocated will, of course, occasionally introduce pure stammering in place of a silent pause. On the other hand, it will often obviate stammering and pauses entirely. Its advantages on the whole greatly outweigh any disadvantages that it might be thought to entail.

It is interesting to note that many empirical systems have taken advantage of this tendency of the auditory sensation to awaken the sound-image. The stammerer is frequently told to prelude his words with a short *e* (*è*) or with the sound of the consonant *m* or *n*. The word *yes* then becomes *eh-yes*, *m-yes*, or *n-yes*. This artifice is thought to enable the stammerer to vocalize after the consonant has been articulated, it being assumed that the stammerer's difficulty lies with phonation. The vocalization is supposed to continue during the articulation of the consonant,

and the stammerer is admonished to maintain continuity of sound throughout the sentence. There can, of course, be no such continuity, for vocalization ceases with every surd consonant. If the initial consonant is mute, vocalization is interrupted even between the introductory sound and the vowel. It is thus evident that the introductory sound does not perform the function attributed to it. If it renders assistance at all, it does so by arousing the torpid auditory image.¹

It seems possible that the auditory image might be aroused more readily if it were associated with some visual image that could be clearly and promptly reintegrated. The visual image would then form a nucleus to which one could resort if the auditory image were not at once forthcoming. It would hold attention for the sound required, and tend to arouse this sound by association. In many cases there seems to be no difficulty whatever in reviving the auditory image when an associated visual nucleus is present. Many stammerers can read without difficulty, though they cannot carry on a fluent conversation. It will be remembered that even aphasic patients are sometimes able to read fluently when they are incapable of spontaneous speech. The rationale of this seems to be that the visual stimulus arouses the auditory

¹ The stammerer is not recommended to resort to the unnatural expedient described. This particular device is cited merely to illustrate the principle under discussion.

image by association, or that it arouses the kinæsthetic image directly, acting itself as a remote inciting image. But whatever the subjective process may be, it is certain that visual verbal images often facilitate speech. The stammerer that can read with fluency should have little difficulty in speech if he could bring before his mind visual images of the words that he utters. The process would be analogous to ordinary reading.

Many subjects would have no difficulty in visualizing words during speech, but others would find the visualizing of polysyllabic words practically impossible. The idea naturally suggests itself that one might visualize only the vowel, for the visual image of the vowel should tend to arouse the mental image of its sound. The phenomenon of chromæsthesia, or color-audition, suggests further that one might visualize the printed or written vowels in colors or upon colored backgrounds. This would make visualization easier for a person possessed of strong color-imagery, and in many instances would facilitate visualization of the entire word. This visualizing of colored words and colored vowels, it will be remembered,¹ is quite natural with some persons; and when the color-imagery is naturally strong, it does not prove at all distracting. Galton says in reference to the phenomenon:²

¹ See p. 39.

² "Inquiries into Human Faculty and its Development," p. 148.

"I will simply remark — First, that the persistence of colour association with sounds is fully as remarkable as that of the Number-Form with numbers. Secondly, that the vowel sounds chiefly evoke them. Thirdly, that the seers are invariably most minute in their description of the precise tint and hue of the colour. They are never satisfied, for instance, with saying 'blue,' but will take a great deal of trouble to express or to match the particular blue they mean. Fourthly, that no two people agree, or hardly ever do so, as to the colour they associate with the same sound. Lastly, that the tendency is very hereditary."

Galton quotes the following description of vowel-imagery by "Mrs. H., the married sister of a well-known man of science":¹

"I do not know how it is with others, but to me the colours of vowels are so strongly marked that I hardly understand their appearing of a different colour, or, what is nearly as bad, colourless to any one. To me they are and always have been, as long as I have known them, of the following tints: —

"*A*, pure white, and like china in texture.

"*E*, red, not transparent; vermilion, with china-white, would represent it.

"*I*, light bright yellow; gamboge.

"*O*, black, but transparent; the colour of deep water seen through thick clear ice.

"*U*, purple.

"*Y*, a dingier colour than *I*.

"The shorter sounds of the vowels are less vivid and pure in colour. Consonants are almost or quite colourless to me, though there is some blackness about *M*.

¹ *Loc. cit.*, pp. 150-151.

“Some association with *U* in the words blue and purple may account for that colour, and possibly the *E* in red may have to do with that also; but I feel as if they were independent of suggestions of that kind.

“My first impulse is to say that the association lies solely in the sounds of the vowels, in which connection I certainly feel it most strongly; but then the thought of the distinct redness of such a [printed or written] word as “*great*,” shows me that the relation must be visual as well as aural. The meaning of words is so unavoidably associated with the sight of them, that I think this association rather overrides the primitive impression of the colour of the vowels, and the word “*violet*” reminds me of its proper colour until I look at the word as a mere collection of letters.

“Of my two daughters, one sees the colours quite differently from this (*A*, blue; *E*, white; *I*, black; *O*, whity-brownish; *U*, opaque brown). The other is only heterodox on the *A* and *O*; *A* being with her black, and *O* white. My sister and I never agreed about these colours, and I doubt whether my two brothers feel the chromatic force of the vowels at all.”

Another correspondent says that *A* is brown, varying in shade according to the “openness” of the vowel. *E* is clear, cold, light-gray blue. *I* is associated with black and *O* with white. The correspondent suggests that the solid type in *I* and the open space in *O* may explain the colors with which these letters are associated. *R* is copper-colored. This correspondent gives the word *visualization* represented in streaks of color, and proceeding conversely gives the verbal interpretation of the colors in several scraps of wall-paper.

Obviously, it would be an easy matter for the stammerer to establish associations of this kind.¹ The associations would doubtless be beneficial to the stammerer that is assisted by visual impressions in reading. Theoretically, the associations should prove beneficial in any case. The writer has made no investigations along this line. The matter has been discussed merely to suggest a possible method by which the auditory image might be aroused through associational channels.

Many psychologists have expressed the opinion that the mental imagery itself can be directly developed and intensified. Unfortunately, most accounts of image-training deal exclusively with the visual imagery. However, it seems reasonable to suppose that if the optical images can be developed, the acoustic images can be developed also. For developing the visualizing faculty, Galton advocates the practice of retaining the primary memory-image and examining it for details that escaped observation during actual per-

¹The association is one of temporal contiguity. One must receive simultaneous impressions through the sense of hearing and the sense of sight. One pronounces the vowel-sound while looking at the object (colored letter, solid color, or white letter on a colored background) with which it is to be associated. Afterward, the vowel-sound is associated with its letter or color in mental imagery. For preference, the short vowels should be associated with the more vivid colors.

ception. He also advocates the practice of multiplying associations. Concerning the latter point he says :¹

"The chief art of strengthening visual as well as every form of memory, lies in multiplying associations; the healthiest memory being that in which all the associations are logical, and toward which all the senses concur in their due proportion. It is wonderful how much the vividness of a recollection is increased when two or more lines of association are simultaneously excited. Thus the inside of a known house is much better visualized when we are looking at its outside than when we are away from it, and some chess-players have told me that it is easier for them to play a game from memory when they have a blank board before them than when they have not."

In another place the writer says :²

"There is abundant evidence that the visualizing faculty admits of being developed by education. The testimony on which I would lay especial stress is derived from the published experiences of M. Lecoq de Boisbaudran, late director of the École Nationale de Dessein, in Paris, which are related in his "Éducation de la Mémoire Pittoresque."³ He trained his pupils with extraordinary success, beginning with the simplest figures. They were made to study the models thoroughly before they tried to draw them from memory. One favorite expedient was to associate the sight memory with the muscular memory, by making his pupils follow at a distance the outlines of the figures with a pencil held in their hands. After three or four months' practice their visual memory became greatly strengthened. They had no difficulty in summoning images at will, in holding

¹ *Loc. cit.*, p. 108.

² *Loc. cit.*, pp. 105-106.

³ "Republished in an 8vo, entitled 'Enseignement Artistique.' Morel et Cie, Paris, 1879."

them steady, and in drawing them. Their copies were executed with marvellous fidelity, as attested by a commission of the Institute, appointed in 1852 to inquire into the matter, of which the eminent painter Horace Vernet was a member. The present Slade Professor of Fine Arts at University College, M. L  gros, was a pupil of M. de Boisbaudran. He has expressed to me his indebtedness to the system, and he has assured me of his own success in teaching others in a somewhat similar way."

In spite of this opinion it seems to be a moot question whether the visual images were actually intensified. Many of the subjects may have been motiles, and their improvement in drawing may have been due to the fact that they relied upon the motor as well as the visual memory. However, Galton is not ambiguous in his opinion concerning the possibility of intensifying the visual images themselves, for he says:¹

"I could mention instances within my own experience in which the visualizing faculty has become strengthened by practice; notably one of an eminent electrical engineer, who had the power of recalling form with unusual precision, but not color. A few weeks after he had replied to my questions, he told me that my inquiries had induced him to practise his color memory, and that he had done so with such success that he was become quite an adept at it, and that the newly acquired power was a source of much pleasure to him."

A single report of this kind is worth a hundred general opinions concerning the possibility of training the mental imagery. Unfortunately, such reports are rare.

¹ *Loc. cit.*, pp. 106-107.

An interesting account of "An Attempt to Train the Visual Memory" appears in the *American Journal of Psychology*.¹ The writer says of her mental imagery previous to the experiment :

"It was predominantly verbal-auditory and verbal-motor, with the first factor a little in the lead.

"The direct visual memory was somewhat developed, though not to the same degree as in most persons. *E.g.*, the name of some one whom I knew rather well would almost invariably call up a visual image, and with some effort I could make its details (form and color) fairly distinct. On the other hand, as I now see upon looking back, class-names very seldom called up a visual impression.

"My verbal-visual memory was very defective. Dates I ordinarily visualized, but not words. So far as I know, I had never at this time had a visual picture of a written or printed word. Of course it is possible, however, that just as one may have a visual local sign without being aware of it until one's attention is called to the matter, so I may have had visual-verbal images, which served their purpose in associations without rising into distinct consciousness."

When listening to reading, the writer was never conscious of visualized words appearing before her mind. She seemed to hear the words again in her own voice and feel them forming in her throat. This imagery was, of course, both auditory and kinæsthetic.

The method pursued in developing the visualizing faculty was to read a few lines of poetry; then to

¹ Vol. VIII, pp. 414 ff.

close the eyes and give as full a description as possible of the disposition of the lines and words, and any details that could be remembered. This description was recorded, and its accuracy tested by reference to the original page. In another exercise, Japanese pictures were scrutinized for ten seconds and then roughly sketched from memory, the sketch being supplemented by an oral description. Comparison was then made with the original.

Concerning the results at the end of six months' practice, the writer says:

"With the poetry my work improved steadily from first to last. At the outset six or seven lines was as much as I could keep in mind at once; near the close of the work I could sometimes give from twenty to twenty-five without a mistake. It must be confessed, however, that I did not always succeed in making my memory purely visual; often I found myself remembering the length of a line in terms of eye-movements.

"With the pictures the progress was not so evident. Naturally it was harder in this case to say whether one was improving or not; especially as each picture in the set was given several times. I am inclined to think there was a slight improvement, but it certainly was not marked. . . .

"At the present time, seven months after the conclusion of the work, I notice considerable improvement, both in the direct visual and in the verbal-visual memory. In attempting very recently to commit some poetry, I found myself depending to a considerable extent upon my verbal-visual memory, whereas a year and a half ago I should have relied wholly upon my verbal-auditory and verbal-motor memories. The effect of the change was apparent rather in greater accuracy than in in-

creased speed of memorizing. In my general reading, too, I have more pictures than I used to have. I am not conscious of visualizing any *better* than formerly—*i.e.*, with any more detail, — but I am conscious of visualizing more frequently.”

One would judge from this report that there was certainly no marked change in the intensity of the visual images. The results do not strongly support the notion that the mental images are always responsive to training. Nevertheless, opinions similar to the following are frequently expressed by psychologists: ¹

“It is astonishing to observe how rapidly this capacity for visualising unfolds in response to a little systematic effort and practice. By devoting to the task a few minutes each day for a week, one may learn to visualise with great detail and remarkable accuracy the form, size, color, etc., of even large and complex objects, such, for example, as great buildings. Frequently at the outset we find that our images are relatively faint, meagre, and unstable; they lack vividness and veracity in color, detail in form, and appropriate dimensions in size. Images of other varieties, auditory, for instance, are similarly defective at times, and yield as a rule to discipline with a corresponding form of development.”

Direct accounts of attempts to train the *auditory* imagery are extremely rare in the literature of psychology. General statements that the development can be effected are, on the contrary, common enough. The method to be pursued is evident. One must

¹ Angell, “Psychology,” pp. 218–219.

attend closely to the auditory sensations (which should be made as clear and sharp as possible), and must allow the primary image to "ring" through the mind. One must continually recall the image, and must endeavor to preserve its fidelity. Secondary memory-images must likewise be made the subject of attention, and one must endeavor to increase the intensity of the image with each repetition. The whole matter is simply one of introspection and attention. It is practically certain, however, that whatever results may be accomplished by this method do not endure unless the mental images are frequently subjected to introspective scrutiny.

An ephemeral strengthening of the auditory imagery seems to be effected by some of the more successful systems of elocutionary training. This fact accounts for the isolated temporary cures accomplished.¹ For several hours a day the stammerer is drilled upon vocal exercises, many of which emphasize the vowel; and for several hours more he reads aloud in order to comply with the requirements of the "system." As a result of this practice the auditory imagery is

¹ Other reasons for the "cures" can also be assigned. Fear and physical stammering are generally eliminated, — the former by the stammerer's confidence in the system, and the latter by the attention given to the conditions required for natural speech. Multiple thought is also precluded for a time by the attention given to various "rules of speech." Thus most of the secondary causes of stammering are temporarily removed.

temporarily intensified, and stammering disappears. When the exercises are discontinued or practised less frequently, the auditory imagery reverts to its former condition, and the stammerer relapses on account of "carelessness."

It is not, however, merely to the intensification of the auditory imagery that the stammerer must look for relief. The auditory imagery is too unreliable and treacherous to warrant confidence in any mitigation of the impediment that its transient intensity may effect. With the occurrence of an illness the imagery is often weakened, and stammering naturally recurs. It is the usual experience of even the cured stammerer that the impediment returns with its old vigor when he is stricken with some debilitating disease. The writer could cite several instances in which principals of "stammering-schools" have themselves suffered a complete relapse. It is probable that such relapses would be only temporary if the stammerer understood the prevailing conditions. Fluency of speech would return when the auditory imagery regained its former intensity. However, the stammerer does not understand the conditions; hence he falls a victim to the secondary causes.

But, if a complete and permanent cure is to be effected, the stammerer must cease to be dependent upon auditory images; for, so long as he relies upon these images as speech-cues, he must *inevitably* stam-

mer when amnesia occurs. If it is possible, the stammerer must learn to depend upon kinæsthetic and visual cues; *i.e.* he must become an articulo-moteur or a visuo-moteur. It is probable that the stammerer can never disregard his auditory images entirely, but if he can supplement them by efficient motor and visual speech-cues, he may be independent of the auditory images when amnesia occurs. But the acquired verbal images will be worthless if they can be recalled only through association with the auditory images. The acquired images must be established as integral and independent parts of the verbal concept, so that the stammerer can reintegrate them *directly*, and speak, like the congenitally deaf person, from kinæsthetic and visual cues.¹

¹The average stammerer would probably find it difficult to develop his kinæsthetic verbal imagery by simply attending to the sensations that the speech-movements produce. He might, however, be assisted by visualizing the movements he is endeavoring to feel. He would probably find the kinæsthetic impressions from the vowels more distinct if the acoustic sensations were excluded from consciousness. This exclusion could not be accomplished by merely sealing the ears. The vocal sound-waves would have to be obliterated by other sound introduced to the auricular canals. (For this purpose, some such simple apparatus as a stethoscope and an electrical "buzzer" could be employed.)

The stammerer would establish his visual cues, like the deaf person, by observing the action of the speech-organs in other subjects, and by observing the action of his own speech-organs in the mirror. (Literature on the training of the deaf can be obtained from *The Volta Bureau*, Washington, D.C.) He might possibly

Teachers of the deaf have in the past often undertaken the treatment of stammering, but they have not generally met with success. The probable reason for their failure is that they have attempted to teach the stammerer to articulate (a thing that he can do perfectly well), and that they have neglected the secondary causes of stammering. The stammerer does not need to be taught to articulate, for his difficulty is merely to produce the correct color of the vowel. If he is to discard his auditory imagery, he must learn to mentally see and feel the different conformations of the oral cavity corresponding to the vowels that he has formerly "heard." He has to learn vowel-positions rather than consonant-movements. Whether or not this can be readily accomplished, and whether the average stammerer can voluntarily ignore his auditory imagery and deliberately resort to artificially acquired cues, remains yet to be ascertained by numerous actual experiments.

The writer has so far made no investigations along this particular line. It is for the reason that he will be unable to make extensive investigations in the immediate future that he publishes the results of his

make some practical use of Bell's "visible speech" symbols. (See Bell's "Visible Speech," etc.) If he visualizes readily, he might picture the words in "visible speech," or in a combination of "visible speech" vowels and ordinary alphabetic consonants. The field of investigation is still unexplored, and it is difficult to state what the most desirable procedure would be.

researches while yet unable to supply the answer to one of the vital questions involved. The writer does not presume, however, to have solved the whole problem of the cause and cure of stammering. This monograph represents, in the main, an attempt to explain the cause of stammering, and to indicate the direction in which the writer believes the only radical and reliable cure is to be found. It is hoped that this volume will carry the necessary conviction to stimulate investigation in the direction suggested.

Yet, whatever the success that may attend the visual education of the stammerer, it is certain that the logical method of handling the defect is to attack the primary disturbance at its very inception — during early childhood — and not first to await the development of complications. If the amnesia is severe, the child can be converted from an *audito-moteur* to an *articulo-moteur*. If the amnesia is not severe, it can generally be counteracted. If the child is taught to suppress all excitement, and to think of the words he is going to utter — to think how they are going to *sound* — he can usually overcome his amnesia. Childhood is the age of plasticity, and in early life one accomplishes with consummate ease what in later years becomes a matter of impossibility. If the primary cause of stammering is allowed to persist, the secondary causes quickly supervene, and pure stammering becomes stammering in its complex form.

But even under these conditions, stammering is more easily remedied at an early age.

A few of the progressive municipalities of Europe and America have instituted special courses in the public schools for the instruction of stammering children. Where the system of instruction has not been lacking in merit, the results have invariably been propitious. The proportion of cures effected is in some accounts given as high as 80 per cent. Even the more conservative reports state that a majority of the children are cured, and that a large proportion of those not cured are greatly benefited by the instruction.¹ There can be absolutely no doubt that in thousands of cases stammering can be eradicated in early childhood, when it would not be amenable to treatment in later life.

It is the obvious duty of every municipality to institute courses of instruction for stammering children, that later they be not "baffled at every turn of life, for want of that most common privilege of man."

¹ See *Brockhaus Enzyklopädie* (14th ed., Vol. 17; article "Stammeln und Stottern"; also *Medizinisch-pädagogische Monatsschrift für die gesamte Sprachheilkunde*, May, 1894, and other issues; also *Werner's Magazine* (New York), February, 1895.

